THE DEVELOPMENT OF AN EVALUATION FRAMEWORK FOR DETERMINING THE PRODUCTIVITY AND EFFECTIVENESS OF INTERNET ROOM DIAGRAMMING SOLUTIONS

Volume 1

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Abstract

Internet Room Diagramming Solutions (RDS) has been regarded as not only one of the most innovative Information and Communication Technologies (ICT) marketing media for raising the profiles of hotel and convention centre properties, but also as a practical tool to try out and to communicate planners' ideas on meeting and event designs. However, there is little research specific to RDS in the hospitality management and the event management research fields. In the first phase of this research, a three-round modified Delphi technique was employed with an expert panel to generate, validate and prioritise a comprehensive set of dimensions and criteria for measuring the productivity and effectiveness of a leading RDS in the marketplace, and a hierarchical structure of these dimensions and criteria is presented. Analytic Hierarchy Process (AHP) was used in the third round to generate relative priorities and to give weightings of these dimensions and criteria. In the phase two of this research, an AHP survey was conducted with the venue operators in the U.S. chain hotel systems for revalidation of the priorities and weightings of the dimensions/criteria which had been previously identified by the Delphi Panel experts. The client base of the leading RDS provider, MeetingMatrix, was used to conduct this survey. Forty-eight effective responses from the survey results have successfully revalidated some of the relative priorities in comparison with the Delphi results. Consistency exists in the priorities of criteria in Impact on Business Partner Relationships, Impact on Customer Satisfaction and Organisational Context. The criteria identified in this research could be adopted in order to conduct further research concerning performance measurements such as the ICT Balanced Scorecard for strategic management. The research methodology and approaches used could also be applied to performance measurements for general innovative ICT applications such as social media.

Keywords: ICT impact; meetings and events; room diagrams; ICT effectiveness; AHP; Delphi method

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List of Abbreviations

AHP	Analytic Hierarchy Process
ANP	Analytic Network Process
CAD	Computer-Aided Design
CRM	Customer Resources Management
DMO	Destination Management Organisation
DMS	Destination Management Systems
DSS	Decision Support Systems
EDI	Electronic Data Interchange
ICCA	International Congress and Convention Association
ICT	Information and Communication Technologies
IT	Information Technologies
KPI	Key Performance Indicator
OECD	Organisation for Economic Co-operation and Development
PCMA	Professional Convention Management Association
PMS	Property Management System
RDS	Room Diagramming Solutions
RFP	Requests for Proposals
ROI	Return on Investment
TAM	Technology Acceptance Model
WWW	World Wide Web

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Chapter One – Introduction

Chapter 1 – Introduction

1.1 Introduction

Stair (1996, p. 5) defines information as “a collection of facts organized in such a way that they have additional value beyond the value of the facts themselves”. Information could also be defined as “data or raw material that has been processed to give it meaning and usefulness” (Collins and Cobanoglu 2008 , p. 8). Thus, effective information systems and technologies, which help to facilitate the transformation processes of information input, calculating, classifying, sorting, summarising, output and storage, enable management to reach predetermined goals in their organisations. Through the effective use of Information and Communication Technologies (ICT), which includes physical telecommunication systems and networks, hardware, software, media and the related services that utilize them (e.g. Internet, audio, mail and so on), it is claimed that competitive advantages, new business models and greater labour productivity could be built in organisations (Ng and Li 2003; The World Bank 2011).

In the field of ICT usage in the hospitality industry, ICT investment has been regarded as an important element for continuous business successes (Buhalis et al. 2011). O’Connor (2004) claims that over the past decades of the explosion in the use of ICT, great attention has been paid to which system and application should be installed first and which one will provide the most benefits to the hospitality business in question rather than whether to computerize or not. It is believed that the hospitality and tourism industries have been transformed through the development of ICT (Reino et al. 2013). It is also argued in the meeting and event industry that the next major group of meetings and events attendees, who are the generation born between 1979 and 2000, have grown up in a period of rapid technological change, especially in the area of ICT (Jones 2007). ICT technology has therefore been easy for them to access. If many of the current and future target attendees of meetings and events will be this generation of the technologically savvy, the meeting and event professionals should prepare and equip themselves with sufficient knowledge of how to effectively adopt efficient ICT applications (Fenich et al. 2011). Casanova et al.

(2005) and Yuan et al. (2006) believe that in the meeting and event industry ICT has provided better customer service, facilitating destination management, leading to the creation of new business models and reducing planning time and costs. Lee et al. (Lee et al. 2013) also believe that the growing variety of general ICT tools have been requested by meeting and event planners to support their work responsibilities. In their research it is claimed that ICT applications may help event planners to achieve their business goal which is to produce a successful event that fulfils a client organisation's objectives and enables the client to better understand the value and service that the planners add to events. However, the quality of the ICT use and the economic impact generated through its implementation should be assessed, particularly when it is used for meeting and event organisations' decision-making such as investment (Kim et al. 2011; Lee et al. 2010).

1.2 The Meetings and Events Industry

In the first ever report which tried to clearly quantify the size and scope of the US meetings industry it is estimated that 1.8 million face-to-face meetings took place in the U.S. in 2009 representing an estimated 205 million participants (PricewaterhouseCoopers 2011). As shown in the Table 1, 263,444 million USD were generated from the direct spending of the 2009 U.S. meeting activities, and of that 263,444 million USD, 10,565 million were spent on venue rental. The landmark and most updated research finding to date indicates the economic significance of the meetings sector to an economy.

Table 1 – Direct Spending on US Meeting Activities in 2009

Sub-sectors		2009 in the U.S.
Core Meetings Industries	Specialized meetings organizers; convention, congress, and exhibition centres; incentive houses and destination management companies; convention and visitor bureaus	USD 112,776 million
Meeting-related Components of the Travel and Tourism Industries	Accommodations; transportation; technical equipment; food services; speakers' representation services; stand construction; other support services; auxiliary businesses	USD 150,668 million
		Total USD 263,444 million

Source: Pricewaterhouse Coopers (2011)

The term meetings in the PricewaterhouseCoopers' report was defined as referring to "a gathering of ten or more participants for a minimum of four hours in a contracted venue" (PricewaterhouseCoopers 2011, p. 3). Conventions, conferences, congresses, trade shows and exhibitions, incentive events and corporate meetings are all included in this portfolio. More strict definitions of meetings have also been used in various organisations: for example, the International Congress and Convention Association (ICCA) which focuses on the associations' meetings has three criteria. In its annual statistics which have been used to produce information for its database since 1972, a meeting should be attended by at least 50 participants, be organized on a regular basis and move between at least 3 different countries (ICCA 2011). However, even from this very narrow point of view, ICCA estimated that in 2010 more than USD three billion has been generated from the registration fees of the meetings market, and over five hundred million people participated in the recorded 4,666 meetings held around the world in 2010.

The size and scope of the meetings and events sector has proved difficult to determine (Fenich 2012). There is a great deal of overlap and interaction between the hospitality and tourism industry and the meetings and events industry. The overlapping relationship is described in Figure 1 explaining and clarifying the economic contribution of the meetings and events sector from a broad viewpoint. A hotel which has food and beverage outlets, retail stores and even entertainment may

be an attraction in itself such as the Disneyland Resorts where the tourists, local residents and meetings and events participants may be all its targets (Disney 2012).

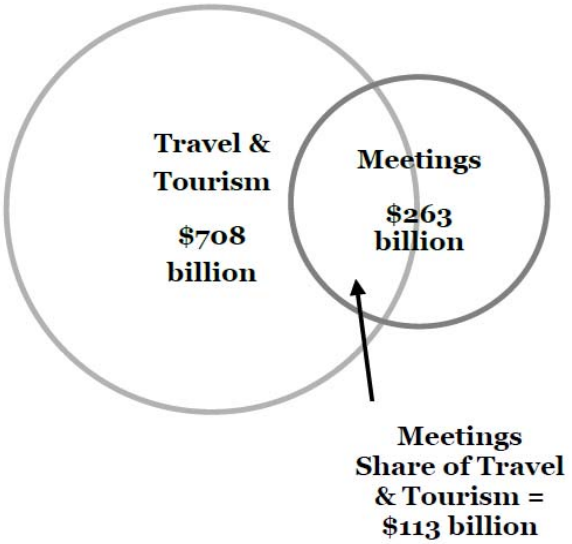


Figure 1 – The Overlapping Relationship between Travel & Tourism Sector and Meetings Sector

Source: Pricewaterhouse Coopers (2011, p. 7)

Due to the inconsistency of measurement of the size of the global meetings industry, specific sectors have also struggled to identify appropriate, valid and reliable measurement tools. One of these sectors is the fast-growing meetings and events technology sector.

1.3 ICT and the Meetings and Events Industry

In the ongoing global economic downturn that commenced in 2008, meeting and event planners are carefully reviewing their pricing models and cutting back operation costs (Lee et al. 2013). The relationship between technology and face-to-face communication has been explored and rethought (Fenich et al. 2011). Meetings and events planning professionals used to view technology as a direct threat to their business opportunities and were afraid of losing their role in the value creation processes: the more technology involved, the fewer in-person events would be held (Flowers and Gregson 2012). However, as one of the creators who coined the term "the Information Society", Alvin Toffler argues that with the great increase in the

amount of information that we all exchange with each other, Information Technologies (IT) have dramatically facilitated the manner in which we communicate and have also helped to synchronize our movements sensibly. “An information bomb is exploding in our midst, showering us with a shrapnel of images and drastically changing the way each of us perceives and acts upon our private world. In shifting from a Second Wave to a Third Wave info-sphere, we are transforming our own psyches” (Toffler 1980, p. 172). He believes that the emergence of both the technologies themselves and the manner in which we use them have changed people’s images of the world and our ability to make some sense of it. Thus human beings have entered a brand new era described as “The Third Wave” compared with the society of the industrial age which is known as the Second Wave. Many scholars, industrialists and world leaders have confirmed Toffler’s vision (Bennett 1999; Ryan 1991). Since then, a great number of new “third-wave-formed” products and services have been provided in the rapidly changing and growing profession of the Information and Communication Technologies (ICT). In the meetings and events industry the planners are now no longer hesitant in the face of technology; instead, technology has come to be regarded as a weapon to better equip their knowledge and expertise for “forming lasting relationships, business partnerships and revolutionary ideas” with their clients (MPI 2011, p. 2). Technology could provide more opportunities for networking beyond the four walls of a meeting space (Fenich 2012). It is believed that meeting and event technology will, in the coming years, remain as a mainstream issue to be discussed and explored in the industry.

In response to an unprecedented range of financial, political, environmental and social pressures, meeting and event professionals constantly work long and hard to discover new technologies, approaches and best practices to sustain business (Fenich et al. 2011). They may lose their younger clients if they do not embrace emerging tools such as Facebook, blogs and conference wikis (Flowers and Gregson 2012). Corbin Ball Associates (2012) lists the categorized meeting and event technologies in its technology blog as shown in the Table 2. The portfolio of this website has been

updated on a regular basis in recent years demonstrating the speed of growth in this niche field.

Table 2 – Corbin Ball's Meetings Technology Links

Abstract and Speaker Management	Mobile Technology: - Mobile Meeting Apps (Multipurpose) - Mobile Meeting Apps (Single Purpose) - RFID - Way Finding (GPS)
Association and Member Management	
Attendee Management/Registration	
Audience Polling/Interactive Response	
AV Companies	
Badge Making	Project Management
Banquet Seating	ROI Measurement
Contact (Customer Relations Management)	Room Diagramming (Floor Plans)
CVB Management (Destination Marketing)	Scheduling
Event and Meetings Logistics Management	Site Selection (RFPs; Auctions; Group Bookings)
Exhibition and Tradeshow Management	SMMP (Meetings Consolidation; Procurement)
Fundraising Events and Auctions	Social Media (Web 2.0; Networking)
Golf and Tournament Events	Surveys
Green Meetings and Hotel Technology	Travel
Groupware and Meeting Facilitation	Virtual Meetings-Shows: - Content Capture and Distribution - 3D Worlds Virtual Environments - Video Conferencing - Virtual Shows and Expos
Hotel (Facility Management and Catering)	
Housing	
Incentive Meetings	
Kiosk (Message Centres; Digital Signage)	
Lead Retrieval (Access Verification)	- Webcasts - Podcasts
Marketing and Communication	- Web Conferencing
Meeting Standards	Web Design

Source: Corbin Ball Associates (2012)

The links identified by Ball indicate the rapid automation through technology of the meetings and events industry. Meeting and event planners have in fact increasingly embraced technological solutions to create economies of scale, achieve greater efficiency and expediency and improve quality (Casanova et al. 2005; Fenich et al. 2011). In addition, Lee et al. (2013) also believe that the growing number of general

ICT tools has been requested by meeting and event planners to support their work responsibilities.

One example of this rapid adoption of meeting and event technology is the study conducted by Meeting Professionals International (MPI) in 2009. 1,832 meeting and event planners and suppliers from 39 countries indicated that virtual and Web-based technologies are growing areas and should gain attention for future development (MPI 2010). The technologies which help to identify and evaluate vendors, locations, and venues such as room layout tools have been placed in the top half of their list of high priorities for investment. Table 3 and Table 4 show that the availability of event venues which meet planners' space requirements is also of great concern to planners.

Table 3 – Destination Selection Priorities, Planners

Destination Selection Priorities, Planners								
	Overall		**Canada**		**EMEA**		**US**	
	2010	**2009**	**2010**	**2009**	**2010**	**2009**	**2010**	**2009**
Overall cost	1	1	1	1	2	2	1	1
Available venues which meet space requirements	2	10	2	8	1	9	2	11
Area hotel rates	3	5	4	6	5	8	3	6
Ease of access/travel	4	3	3	2	3	1	4	4
Value	5	8	5	8	7	5	5	8
Attractive location to attendees	6	7	6	6	6	4	6	8
Availability of airlift	7	2	8	5	7	3	7	2
Travel costs to destination	8	4	7	4	7	8	8	3
Proximity to members/attendees	9	6	5	6	7	7	9	7
Distance between airport and preferred hotels and venues	10	12	8	8	4	6	10	13
Public perception	11	N/A	8	N/A	8	N/A	11	N/A
Customer service reputation or culture of the area	12	9	8	7	7	7	12	10
Attractions and activities	13	12	9	7	8	6	13	9
Climate	14	11	10	N/A	9	8	14	12
Other	15	N/A	8	N/A	9	N/A	15	N/A

Source: MPI (2010, p. 6)

Table 4 – Meeting Venue Selection Priorities, Planners

Destination Selection Priorities, Planners								
	Overall		**Canada**		**EMEA**		**US**	
	2010	**2009**	**2010**	**2009**	**2010**	**2009**	**2010**	**2009**
Overall cost	1	1	1	1	2	2	1	1
Available venues which meet space requirements	2	10	2	8	1	9	2	11
Area hotel rates	3	5	4	6	5	8	3	6
Ease of access/travel	4	3	3	2	3	1	4	4
Value	5	8	5	8	7	5	5	8
Attractive location to attendees	6	7	6	6	6	4	6	8
Availability of airlift	7	2	8	5	7	3	7	2
Travel costs to destination	8	4	7	4	7	8	8	3
Proximity to members/attendees	9	6	5	6	7	7	9	7
Distance between airport and preferred hotels and venues	10	12	8	8	4	6	10	13
Public perception	11	N/A	8	N/A	8	N/A	11	N/A
Customer service reputation or culture of the area	12	9	8	7	7	7	12	10
Attractions and activities	13	12	9	7	8	6	13	9
Climate	14	11	10	N/A	9	8	14	12
Other	15	N/A	8	N/A	9	N/A	15	N/A

Source: MPI (2010, p.7)

One of the key areas identified in the MPI study is the need to identify critical resources in the planning process. One of the essential and primary resources is venue site selection (DiPietro et al. 2008; Fawzy and Samra 2008; Hassanien and Dale 2011; Soyoung et al. 2008). Therefore, site selection must be carefully and efficiently conducted, and emerging technologies are increasingly supporting this aspect of meeting and event planning.

1.4 Site Selection and the Distribution of the Venue Product

"Every event is held somewhere – a specific space and place" (Silvers 2012, p. 60). Site selection needs to be made early when planning meetings or events because there could be limited ideal venues available (Goldblatt 2011). It was estimated that in 2009 USD 10,565 million was spent on venue rental which accounts for almost 9.4% of total direct spending generated by the core meetings industries in the U.S. (PricewaterhouseCoopers 2011). Getz (2005) considers that accessibility, visibility and consumer knowledge of venues could be used as criteria for venue selection process. Physical requirements of an ideal venue such as size, safety and security regulations and availability of furniture could be determined through site inspections (Monroe 2006). This task used to be conducted mainly by persons visiting venues. However, modern technology such as Internet has provided cost effective and accurate approaches to greatly expedite the site inspection process. Torrence (2003) believes that the Internet innovations implemented in the meeting and event industry dramatically reduce response time and transform traditional ways of doing business. Meeting and event planners can evaluate and compare event venues through the content provided on the Internet (Lee et al. 2013). Time and money are saved; efficiencies and productivity are improved through the implementation.

Fenich (2012) indicates that it is estimated that over one-half of all meetings have been booked without a formal site inspection in recent years, and this number continues to grow. The development of a web-based database with the support of information retrieval and search engine techniques makes the selection of thousands of venues throughout the world just a click away (Goldblatt 2011). This development dramatically changes the previous one-way communication. With real-time communication, open standard, public access, highest connectivity and global connectedness, meetings and events planning communication has clearly become a two way model (Fuchs et al. 2010; MET LAB 2011).

The provision of digital photos, video streams and even 360 degree panoramic tours of meeting spaces has been implemented for many years. With the support of computer-aided design techniques, venue operators nowadays can further offer

certified Internet room diagrams which are physically measured by third-party organisations who measure the facilities' meeting space and then give the guarantee that the measurements are accurate to a given degree to potential clients. The software solution service providers may visit and measure the venue in person with cross-reference to the blueprints of the venues in order to build guaranteed accurate room diagrams. Meeting and event planners can then repeatedly use the digital diagrams to create setups and layouts of their events. The professionals can also examine the precise room setups in a three-dimensional (3D) virtual tour to facilitate better dialogue with the venue managers and suppliers. A click of a button transfers the accurate sizes of windows, chairs, lighting and special decorations to a virtual 3D walkthrough, and viewers may not even be aware if the scenes are real or virtual (Fenich 2012).

1.5 Evaluating Internet Room Diagramming Solutions

Tornatzky and Klein (1982) claim that an ideal study for innovation characteristics should not solely consider the adoption decision but both adoption and implementation through utilization or routinization which means that the adopted technology becomes 'routinized' as part of each day's normal activity. The variability of post-adoption behaviour could be captured through measures of degree of implementation. However, in their meta-analysis research to seventy-five articles pertaining to innovation characteristics, merely 6.7% considered post-adoption behaviour.

The global financial crisis has forced industry practitioners to provide detailed proof of Return on Investment (ROI) in order to convince their clients that strategic imperatives have been achieved. According to the IMEX Global Insights Report (2011), 25% of the responses which come from 45 senior industry professionals in meetings, events and incentives said that their most or second most important priority will be to demonstrate an understandable ROI management and measurement system. In recent editions of MPI FutureWatch reports, steadily growing interest has also been focused on the issues of value created and ROI in the circle of meeting and event suppliers and planners (MPI 2010).

Room Diagramming Solutions (RDS) have been used to generate electronic graphic room layouts and design seating plans and room set-up diagrams in order to facilitate the communication between meeting and event planners and the event venues they use (O'Connor 2004). Some software systems allow the users to access a certified room diagram showing the dimensionally accurate size and shape of each object, thus ensuring that the set-up diagrams they design on screen will work on the ground. More and more meeting and event planners expect to use technology such as RDS to assist them in their planning process (Ball 2007). Furthermore, it has been claimed that RDS can leverage properties' marketing efforts (MeetingMatrix 2012). However, it has been argued that there is a gap between the importance of this technology tool and the added value that sales personnel perceive the tools bring in terms of their daily sales responsibilities; previous research considers that insufficient follow-up training could be one of the reasons causing this gap (Jones and Baloglu 2006).

In order to build on its success, it is now of critical importance for Room Diagramming Solutions (RDS), as an important Information and Communication Technologies (ICT) tool for meeting and event planners, to justify its business value using quantifiable performance measures which will assist venue managers to ensure the efficient use of this technology tool. Researchers have recognised that ICT cannot guarantee profitability unless "certain prerequisites are satisfied, namely long term planning, innovative business processes re-engineering, top management commitment and training throughout the hierarchy" (Buhalis 1998, p. 410). It has also been argued that different ICT applications contribute in varying extents to business performance and contribute in diverse ways, especially in the hospitality industry, and these applications should be measured by different criteria (Fuchs et al. 2010; Ham et al. 2005). Some efforts toward the development of an evaluation framework measuring effectiveness have been made in the field of hospitality management for Destination Management Systems (DMS) (Fuchs et al. 2010; Horan 2010). Effectiveness is defined as the extent to which a desired set of goals or outcomes is achieved (Horan 2010). However, to the author's best knowledge, there is no relevant research specific to RDS which can provide a generally accepted

evaluation framework to assess the economic value and effectiveness of RDS in the meeting & event industry. Therefore, this research intends to bridge this gap.

1.6 Research Aim and Objectives

This research addresses the concerns about how event venues may utilize the advantages offered by today's Information and Communication Technology (ICT), particularly Room Diagramming Solutions (RDS), to better compete for incoming global meeting and event industry and improve its profitability and continuous success. A defined research problem may be used, as the first step, to provide clarification in any research project (Blaxter et al. 2003). There is a gap in the assessment studies of the adoption of Internet RDS within both meeting and event and eTourism literature. To the author' best knowledge, only limited previous studies include RDS within their research on eBusiness applications, and there are no published academic articles that focus on the economic value and effectiveness of Room Diagramming Solutions to venue operators (Jones and Baloglu 2006; UNLV 2001). Thus, this research intended to develop a framework to help event venue managers to monitor the economic sustainable efficiency of their Room Diagramming Solutions. The aim of this research is to incorporate a comprehensive set of dimensions and criteria to develop a flexible and practical indicator system for the evaluation of the economic value and effectiveness of RDS.

The objectives of this research are to:

- construct a methodology for the evaluation of the economic sustainable effectiveness of RDS,
- establish the relative value of implementing RDS in event venues,
- generate a comprehensive set of dimensions for the evaluation of the economic sustainable effectiveness of RDS,
- identify key stakeholders' views on the criteria used to measure RDS system effectiveness,
- weight the dimensions/criteria identified according to the views of venue managers.

This research result may also be able to help promote greater understanding of the general ICT efficiency and productivity issues which concern meeting and event venue managers in the real world. The definition of economic sustainable effectiveness could be widen to business sustainability as suggested by Sadler (Sadler 2003 p. 39), “in business, sustainability means managing human and natural capital with the same vigour we apply to the management of financial capital”. The research processes (framework development) also have the potential, in the future, to be adapted to tackle the issues of sustainable business development for other specific areas: for example, sustainability measurement and monitoring of festivals and events.

1.7 Chapter Outline

This section outlines the content of each of the chapters in this dissertation in an attempt to provide a clear “road-map” of the process and rationale taken throughout this study as a means of achieving its aim.

Chapter One – The Introduction: this chapter outlines the research problem, the main objectives and introduces the conceptual building blocks of the research. It provides an overview of the aim, the pertinent concepts and the structure of the dissertation and generally sets the scene for the remainder of the dissertation.

Chapter Two – Literature Review: this chapter provides further understanding of the research topic. The literature review of this project has borrowed materials and research concerning venue selection, meeting and event technology applications, the economic evaluation models used in the general adoption of Information and Communication Technologies from relevant fields such as tourism and hospitality management.

Chapter Three – Methodology and Methods: this chapter describes the methodology and techniques used in this research. The following topics will be covered: the reasons for the discussion of philosophical issues; ontology and epistemology of economic value and effectiveness; method description of the

modified Delphi study and the Analytic Hierarchy Process (AHP); the reasons for adoption of the modified Delphi method and AHP; the research design; how to trust findings.

Chapter Four – Modified Delphi Study Results: this chapter provides the findings from the modified Delphi study. The aim of this modified Delphi study was to generate a comprehensive set of dimensions for the evaluation of the economic value and effectiveness of RDS. Through identifying key stakeholders' views on the criteria used to measure RDS system effectiveness, the developed framework can be used to monitor the post-adoption economic value and effectiveness of RDS.

Chapter Five – Analysis: Analytic Hierarchy Process Results: this chapter provides the findings from the Analytic Hierarchy Process (AHP) mass survey. The aim of this AHP mass survey was to revalidate the priorities and weightings of the dimensions/criteria for monitoring the post-adoption economic value and effectiveness of RDS which were identified by the Delphi Panel experts according to the views of the venue operators in the US chain hotel systems.

Chapter Six – Comparisons of Delphi and AHP Results: the finalised criteria within the developed indicator system in this research have been rated and ranked three times (Modified Delphi Round Two; Modified Delphi Round Three; AHP Mass Survey) by different techniques (Likert Scale; AHP Technique) through two groups (Expert Panel; Industrial Practitioners). Additional findings from the comparisons of the rankings of the criteria, factor tiers and categories have been generated.

Chapter Seven – Conclusions and Recommendations: the thesis concludes with the recommendations and practical implications from this research and the directions for future research within this domain.

Chapter 2 – Literature Review

Chapter 2 – Literature Review

2.1 Introduction

Conducting a literature review could provide further understanding of the research topic: it identifies similar studies done within the topic area and how the research has been carried out; it allows the comparison of previous findings and the exploration of knowledge gaps that demand further investigation (Hart 1998). It is found that specific studies concerning the economic value and effectiveness of Room Diagramming Solutions in the event management domain are sparse (Jones and Baloglu 2006; UNLV 2001). Therefore, the literature review of this project has borrowed materials and research concerning venue selection, meeting and event technology applications, the economic evaluation models used in the general adoption of Information and Communication Technologies from relevant fields such as tourism and hospitality management.

2.2 Meeting and Event Venue Organisations and Venue Selection

Hotels, arenas, convention centres, stadia or theatres and many other venue types, as shown in the Table 5, are often the places where meetings and events are held (Monroe 2006). For example, purpose-built exhibition and convention centres are best suited for trade and consumer shows while theatres accommodate performance events (Getz 2007). Meeting and event professionals can rent these venues that have their own management systems such as for seating, viewing and listening for the planned events. In the event planning processes, the costs of venue rental typically account for a great portion of the total budget of a meeting or event (Fenich 2012; Lee et al. 2010). It is believed that the selection of appropriate venues for the planned meeting and events could be one of the most important and difficult tasks for the planners (Chiappa 2012).

Table 5 – Types of Venues

Standard Venues	Nonstandard Venues	Unique Venues
For Corporate Events	*For Corporate Events*	Airports
Conference centres	Country clubs	Museums, concert halls, and historical sites
Convention centres	Museums, concert halls, and historical sites	Pastures, fields, barns, and other rural spaces
Hotels	Pastures, fields, barns, and other rural spaces	Racetracks
	Residences	Residences
	Restaurants/nightclubs	Stadiums and arenas
	Stadiums and arenas	Stand-alone event venues
	Stand-alone event venues	State and county fairgrounds, renaissance fairs
	State and county fairgrounds, renaissance fairs	Streets, parks, parking lots, and other urban spaces
	Streets, parks, parking lots, and other urban spaces	
	University and corporate campuses	
For Life-Cycle Events	*For Life-Cycle Events*	
Community centres	Conferences centres, convention centres, and other corporate venues	
Hotels/country clubs	Pastures, fields, barns, and other rural spaces	
Religious institutions	Stadiums and arenas	
Restaurants/nightclubs	State and county fairs, renaissance fairs	
Stand-alone event venues	Streets, parks, parking lots, and other urban spaces	
For Festivals and Fairs	*For Festival and Fairs*	
Pastures, fields, barns, and other rural spaces	Airports	
Stadiums and arenas	Racetracks	
State and county fairgrounds, renaissance fairs	Other large appropriate spaces	
Streets, parks, parking lots, and other urban spaces		

Source: Monroe (2006, p. 41)

Site selection has been widely researched in the meeting and event sector (Baloglu and Love 2001; Chen 2006; Crouch and Louviere 2004; Kang et al. 2005; Morgan 2006). Research into venue selection, which has a narrower focus from the site selection point of view, has, however, seldom been conducted in the academic field

(Daniels et al. 2012). Although site selection and venue selection may have different emphases, they still share some common characteristics in terms of the selection processes such as the distinctive and memorable appeal contributed to the planned events (Morgan 2006). An ideal meeting and event venue can also improve the overall image of the planned events held, boost participation and then hopefully result in financial success (Getz 2007; Silvers 2012). The so-called “wow factor”, which is composed of the element of surprise and specialness created by event design, could also be affected by venue selection (Bowdin et al. 2010). The event venue may also be part of the event theme and creativity.

In a research paper on festivals, one of the major sub-sectors of the events industry, conducted by (Getz et al. 2007) in Sweden, venue providers have been ranked highly in the map of the major stakeholder roles in festival networks as shown in Figure 2. A further comparison research conducted by Getz and Andersson (2010) in UK, Australia, Norway and Sweden confirmed this point of view, and the event organizers surveyed in this research indicated a high level of dependence on their venue providers: venues/facilities used were ranked in first place followed by local government/shire and paying customers regarding their dependence on specific stakeholders. This research argues that event organizers with a high dependence on venues used suggests an attitude of product-orientation rather than a marketing orientation. As mentioned above in Bowdin et al. (2010), this perspective echoes the “wow-factor” that event organizers would like to create by venue selection.

Figure 2 – Major Stakeholder Roles in Festival Networks

Source: Getz et al. (2007, p. 109)

As the explosion of the use of Internet and World Wide Web, meeting and event planners now have powerful resources with which to plan their events and to research, to understand, to communicate and to verify the venues where they would like to conduct their meetings and events through these modern technologies (Fenich 2012). Apart from finding the right fit between event and facility, venue selection could not neglect the human factor and relationships involved. It is suggested that the technological innovations in the meeting and event industry such as Room Diagramming Solutions (RDS) should be used to improve efficiency and productivity, to gain cost savings and, most important of all, to enhance relationships among event stakeholders (Torrence 2003). It is believed that ICT innovations such as RDS in the meeting and event industry affect relationship building among event stakeholders and make relationships stronger and more professional (Torrence 2003). Online communication and web sites allow the task of selection of event venues, through eBusiness solutions, to be looked after directly by preferred professional companies and venue sales managers. eBusiness refers to using the Internet platform

in conjunction with the existing ICT infrastructure to conduct transactions along the value chain throughout the purchasing and selling processes (Zhu et al. 2006).

2.3 Meeting and Event ICT

Technology has come to be regarded as a weapon to better equip the knowledge and expertise of meeting and event planners for "forming lasting relationships, business partnerships and revolutionary ideas" with their clients (MPI 2011 p. 2). Technology could provide more opportunities for networking beyond the four walls of a meeting space (Fenich 2012). In response to an unprecedented range of financial, political, environmental and social pressures, meeting and event professionals constantly work long and hard to discover new technologies, approaches and best practices to sustain business (Flowers and Gregson 2012). They may lose their younger clients if they do not embrace emerging tools such as Facebook, blogs and conference wikis (Fenich et al. 2011). For example, Torrence (2003) claims that site selection, in this era of technological revolution, has heavily benefited from the use of the Internet which she calls "the new face of site selection". Meeting and event planners can access sites via webs, take 360-degree visual tours, exchange Requests for Proposals (RFPs) and review e-contracts anytime and anywhere, and their invaluable time and money will have been saved. Venue managers can also respond in detail and quickly to inquiries such as availability and potential rates for the event space in which clients are interested through the use of emails and eBusiness solutions. Toffler (1980, p. 388) claimed that "the popular fear that computers and telecommunications will deprive us of face-to-face contact and make human relations more vicarious is naive and simplistic. In fact, the reverse might very well be the case. While some office or factory relationships might be attenuated, bonds in the home and the community could well be strengthened by these new technologies. Computers and communications can help us create community". It is quite suitable to use the field of event management which is described as "the scientific process through celebration to promote positive outcomes for all of society" to examine Toffler's vision (Goldblatt 2011, p. xii). From pre-event (apriori) communications with staff and volunteers as well as prospective attendees to post-event (post-hoc) evaluation and transfer of knowledge, Information and Communication Technologies (ICT) serve as

a vital tool for communication, innovation and transfer of knowledge throughout the modern meetings and events industry. This technology may be used, among other applications, to promote initial interest in the meeting or event, to facilitate collaboration between stakeholders through advanced real time communications, to connect meeting attendees and others before, during and following the meeting or event for future discussion, to design the diagrams for the room setups, to develop the formative and summative evaluation for the meeting or event, to facilitate transactions anytime and anywhere (MET LAB 2011).

Recent development in telecommunications enables meeting and event professionals to perform efficiently and is a very important milestone in technological advances. The computer software products and services for meeting and event management automate many of the administrative and logistic functions which used to be time-consuming and human-capital-intensive (Krugman 2007). From laying out a timetable, selecting venues, designing diagrams to inspecting venues, the full-featured PC-based or web-based software programs allow meeting and event professionals to track and check the progress of their tasks in the planning process with ease. Table 6 lists some of the categories of the software used in meeting and event planning processes. Many of these applications are integrated in a single system and allow users to consolidate information and transfer information from one application to another with a click. This dramatically changes the ways in which people used to generate, receive, collect, seek out, send out, sort, analyse and store a broad range of information when conducting event management (Silvers 2012). Torrence (2003) claimed that meeting and event technology innovations such as meeting management sites and Room Diagramming Solutions could be used to communicate with staff, to track meetings and spending and to calculate return on investment. However, it is argued that meetings and events, especially one-off special events and festivals, work in a complex, uncertain and changing environment. As a result, the use of software for meeting and event management is limited (Bowdin et al. 2010).

Table 6 – Typical Computer Software Used for Event Coordination

Accounting	Graphics
CAD (Computer-Aided Design)	Project/Event Management
Catering	Registration/Housing Management
Content Management	Rental/Inventory Management
Database	Scheduling
Desktop Publishing	Spreadsheet
Diagramming/Floorplan	Word Processing

Source: Silvers (2012, p. 406)

However, there are several stable and more predictable areas, such as event promotion schedules, in the event planning processes where event software packages can supply assistance and increase efficiency. The developers of the Global Distribution Systems (GDS), which make the products and services available electronically, were pioneers in the application of ICT in the hospitality industry (Connolly et al. 1998; O'Connor 2004). Hotels and event venues could upload their room and space details, descriptions and price categories onto the web-based GDS and World Wide Web (WWW). As a result, thousands of meeting and event planners worldwide can reach the information by Internet and make reservations for the venues where planned meetings and events will be held. Making repeated inquiries about availability, price and rates by phone to different venue organisations was a thing of the past (Brady 1995). Considering that meeting and event room layouts and setups vary in different venues, photos, blueprints, floor plans and virtual tours have been provided on WWW to enrich the one-way information disclosure. However, the photographs or even videos clips may not give a realistic view of the venue if it is being used for event design. Meetings and events held in the same venue usually need diverse seating arrangements and space setups (Radde 2009). With the emerging need for bilateral communication in the complex event planning processes, meeting and event venue organisations have started to provide digital room diagram files which can be distributed by WWW and be collaboratively edited in the designated Computer-Aided Designing (CAD) room diagramming software in users' electronic devices (Fenich 2012).

2.4 Room Diagramming Solutions

With the development of computer technologies, an accurate diagram of event space can be created and edited using simple graphics software or dedicated Computer-Aided Designing (CAD) programs (Silvers 2012). It is claimed that the first commercial room diagramming and drawing application product which assisted meeting and event planning in the hospitality industry made available in the 1980s (Ball 2007; MeetingMatrix 2012). Room Diagramming Solutions (RDS) typically assist in the generation of digital graphic room layouts for both the meeting and event venue organisations and their clients. This computer software which provides the same functionality as conventional CAD programs also allows meeting and event planners to try out their ideas on event designs (McCormick 2004). It is believed that with the assistance of RDS, meeting and event planners no longer need to think visually and imagine a room setup for the events they are planning (Bielski 1997). RDS, therefore, can be viewed as an invaluable planning tool for finding a solution to space design issues. Some of the applications provide certified room diagrams showing the accurate size and shape of each meeting and event room and space and the objects in the rooms such as tables and chairs. The capability of the accurate room diagramming solutions ensures that whatever the meeting and event professionals design on screen can work on the ground (O'Connor 2004). It is claimed that both event planners and suppliers such as venue providers, by embracing ICT innovations like RDS, can benefit in terms of improved efficiency and productivity (Torrence 2003). The time and effort saved could be used by the event planners to focus on return on investment and the set agenda rather than purely on logistics. As for venue operators, better service could, therefore, be provided, and the technological innovations may build a new client base through new channels such as online Requests for Proposals (RFPs).

The Professional Convention Management Association (PCMA), which was founded in 1957, is one of the renowned organisations for the promotion of the value of professional convention and meeting management (Fenich 2012; Goldblatt 2011). A “Space Verification Program” was initiated in 1994 by PCMA in order to help meeting planners and venues to validate meeting and event room specifications

(Rogers 2008, p. 294). In response to the need from both meeting and event planners and venue managers for the third-party guaranteed electronic blueprints, the program was expanded in 1997 (Bielski 1997). A team of surveyors from PCMA were sent to the participating hotels and venues to conduct space inspections and measurements and this resulted in the rendering of electronic room diagrams for planners to view. The resulting approved space verification seals were requested by some managers in hotels and venues as new promotional materials for their properties. These venue professionals were in the habit of underselling space because of the worries about potentially inaccurate blueprints and room setups. It is argued that the actual specifications and room layout of venues offered by providers may differ and might have been changed from the original architect's plans between the design and building period. Hoteliers should not, therefore, rely solely on the architect's renderings and blueprints to sell their venue space (Bielski 1997). It is believed that the PCMA program relieved these worries and mitigated the potential risk of underselling or overselling available space. Although considerable investment was needed in order to receive verification of the space in the venues, taking a long-term view, the space verification may also reduce the potential costs which are incurred by poor communication such as misunderstanding of the local fire and safety codes in inaccurate room diagrams.

At first, the software "Optimum Settings for Meeting Planners", which belonged to CEO Software company and was one of the renowned RDS suppliers, was used as the industrial standard for the PCMA space-verified properties (Torrence 2003). This software was later acquired in 2003 by Newmarket International which is one of the leaders in delivering group, sales, catering and banquet software solutions to global travel and entertainment organisations (Hotel News Resource 2003). The certified room diagrams and floor plans of the participating hotels and facilities could be downloaded from the PCMA website and be opened with Optimum Settings for Meeting Planners software. The software, which allowed meeting and event professionals to create required room setups and seating arrangements, facilitated the communication in detail among planners and property staff. Time spent on

contacting clients to clarify specific requirements could be saved, because the detailed necessary information is included in the platform provided by the software.

The PCMA Space Verification was further developed in 2005 through the partnership with MeetingMatrix International, which is one of the renowned providers of interactive diagramming solutions for the hospitality industry (Davis 2005). It was claimed that MeetingMatrix, which was founded in 1988, held approximately 80 percentage of the captured market share in both software and diagramming solutions for the global meeting industry (Business Wire 2005). Under this new partnership, every participating hotel and venue has first to be certified by Installation Managers from MeetingMatrix. The managers physically measure the facilities' meeting space and then give the guarantee that the measurements are accurate to within one-fourth of an inch. Meeting and event planners can also use 3D-VR technology developed by MeetingMatrix to easily generate realistic, three-dimensional models of their digital event room diagrams. The event clients of the planners could, therefore, also experience and take a virtual "walk through" the created space design and sitting arrangements through the navigation. Over 65,000 electronic room diagrams can be accessed through the use of MeetingMatrix RDS products and services (PCMA 2013). It is claimed by PCMA Chief Partner Relations Officer Sherrif Karamat that MeetingMatrix RDS is one of the latest and most accurate tools in the meetings industry for the planning and execution of meeting logistics (TravelDailyNews 2007).

The use of the room diagramming solutions in the meeting and event industry and in the hospitality industry has changed greatly over the past decades. Accompanied by the continuous development of the Information and Communication Technologies (ICT), rich functionality has continued to grow in the room diagramming solutions. Meeting and event professionals can download room diagrams and floor plans directly from the venues' websites allowing the time-consuming jobs of the past to be completed with ease (Corbin Ball Associates 1999). Some packages, equipped with the technologies of three-dimensional (3D) virtual reality and space rendering, even allow users to walk through the 3D rooms they have designed on the screen

(Hotel Interactive 2006). The users can take advantage of search engines to conduct meeting and event venue research and to identify ideal venues for their events without traditional costly site inspections (Bowdin et al. 2010). RDS could be used by meeting and event planners as a guide during the often stressful time of checking out venues (Bielski 1997). The Internet-based search capabilities of RDS innovation lead to a closer match between venue organisations and their customers such as event planners with greater reach than before. With the support of cloud computing technology, users can directly design the event setups on the web pages of the targeted venues ignoring the complicated software downloading processes of the past (E-Hospitality 2011). Torrence (2003) believes that the functionality of an interactive accurate floor plan in event management websites is one of the new most desirable features requested by meeting and event planners. This digital Internet demonstration approach showcases the properties and space of a venue in a brand new way: for example, users can modify meeting and event room layouts on a web-based interactive map (Haley 2006). As a result, apart from the original design functionality, more and more meeting and event professionals regard the room diagramming solutions as a communication and marketing tool (Bowdin et al. 2010; Collins and Cobanoglu 2008; Goldblatt 2011; Jones and Baloglu 2006). Cho et al. (2002) consider by the provision of 3D web-based virtual experience, which use environmental simulations, the image of a physical place could be created and communicated without actually visiting the place. It is also claimed by Fiore et al. (2005) that the adoption of 3D interactive websites could help the consumers make more informed decisions and could advance customer loyalty and word-of-mouth advertising. It is claimed that the detailed and formatted information contained in RDS such as the default cross aisle width or the distance between chairs could help to improve the efficiency of communication among event stakeholders and provide an outlet for transmitting a completed request or issue (Torrence 2003).

In the hotel sector, one of the major locations hosting meetings and events, some efforts have been made to analyse the value provided by Room Diagramming Solutions (RDS) to property management and to categorize RDS in diverse systematic ways. It is claimed that hotels could use space verification such as PCMA

Space Verification Program as a selling tool (Bielski 1997). Collins and Cobanoglu (2008) emphasize the ability of RDS to increase sales and then categorize in RDS as one of the sales and catering systems in property management. However, considering the fact that meeting/event rooms usually belong to specific sub-units which differ from other divisions of properties, RDS is also classified as one of the conference and banqueting systems as shown in Figure 3 (O'Connor 2004). It is described that the concept and boundaries of hotel systems such as Property Management System (PMS) are not consistent across suppliers, solutions and properties, and the systems could be provided in customized modules and features of specific requirements (Reino 2009). It is also claimed that RDS can simplify planner-hotel communication, bring business and increase sales for the venues (Bielski 1997). In Jones and Baloglu's research (2006) the focus on RDS is on its ability to expand properties' exposure promoted by Internet marketing endeavour, and they, therefore, describe RDS as a sales and marketing tool.

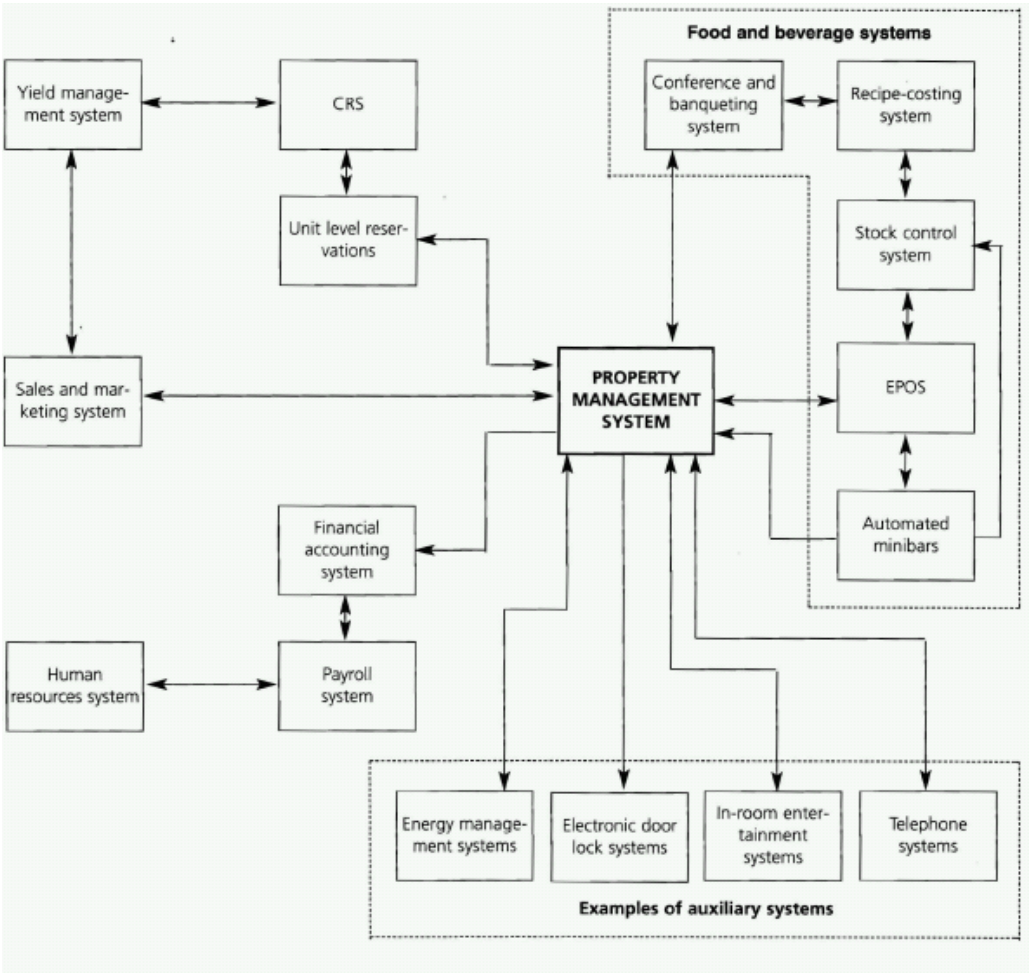


Figure 3 – An Integrated Hotel System

Source: O'Connor (2004, p. 207)

In the field of event management, (Silvers 2012) states the importance of the multi-functionality of an RDS from the perspectives of the key stakeholders involved in the event planning processes and suggests that the event setup diagrams should be circulated to the different stakeholders for their review and recommendations. As shown in Figure 4, clients, vendors, staff, participants or authorities learn how the space can be used in meetings and events from the illustrated floor plans/maps and room diagrams. RDS helps the key stakeholders to determine the usage of the event sites, to identify possible problem areas for the logistics managers, to provide information for the occupational health and safety consultation process, to familiarize attendees with the site layouts and to market meetings and events by showing where

entertainment, food concessions, direction signs and exhibitors are situated (Bowdin et al. 2010; MET LAB 2011; Silvers 2012). RDS also bridges the conversation among these key stakeholders to explain their thinking to each other using state-of-art interactive diagramming technology.

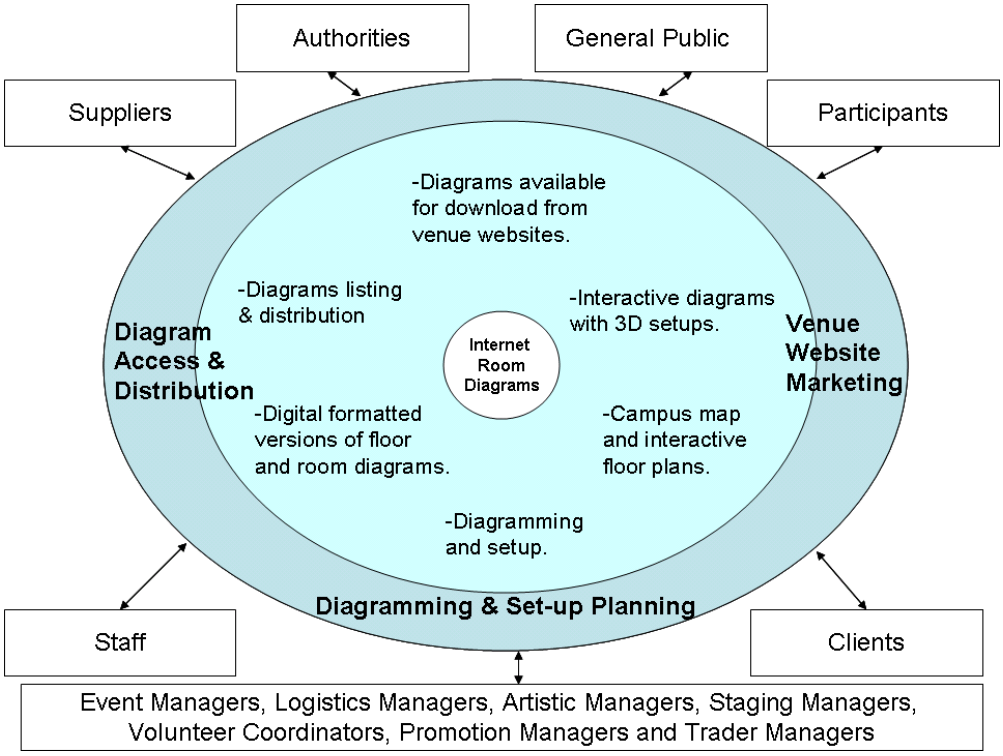


Figure 4 – Different Uses of Room Diagramming Solutions by Key Stakeholders in the Meeting and Event Planning Processes

Source: Bowdin (2010), MET LAB (2011) and Silvers (2012) adapted for this research

The Internet interactive CAD room diagramming solutions not only take advantage of the conventional CAD software for design drawing but also extend the capabilities of varied key stakeholders who use it to attend, to be involved with or to produce better meetings and events. It is found that implementing general CAD software systems may increase the productivity of the designer, improve the quality of design, improve communications through documentation and create a database for manufacturing (Narayan 2008). It is claimed that the use of Internet interactive CAD, a new form of communication, transforms both the substance of literacy and the

means by which the content is communicated and learned (McCormick and Scrimshaw 2001). This platform, which allows more creative approaches for collaboration, accommodates both traditional individual creativity and 'collective generativity' which was described as the ability of distributed communities to engage collectively in bottom-up processes of creation and innovation (Sandes 2000, p. 11). Maher et al. (2000, p. 103) describe the characteristics of the collaborative design development in a virtual environment as "a process of construction of individual and shared understanding and the mapping of this understanding onto a shared design representation". The result of the collective intelligence generated by this approach goes beyond simply having a team of event planners and designers: it could embrace the involvement of clients, suppliers and consumers. As a result, the use of Internet interactive CAD room diagramming solutions may add tangible and intangible values to complex projects such as meeting and event planning (Collins and Cobanoglu 2008; McCormick 2004). RDS, which is similar to other ICT applications in hospitality sector, could improve "interoperability" as described by Buhalis et al. (2011, p. 211): through electronically facilitating partners' communication by effective methods, right information could be delivered to right users at the right time and cost. It is claimed that the adoption of RDS in venues may give guaranteed satisfaction to meeting planners, attract more planners and increase revenue customer service and repeat business (PCMA 2013).

However, it is argued that from the perspective of cost-efficiency (financial and training-time) and the gap between the importance of computerization and technology tools and the users' satisfaction level with those tools, the investment in the sophisticated and customized RDS should be considered wisely and carefully (Jones and Baloglu 2006; Silvers 2012).

Jones and Baloglu (2006) surveyed the hotel sales members from the Hotel Sales and Marketing Association International (HSMAI) and several hotel companies by using a list of twenty technological tools used in hotel sales. The survey asked the sales members for ratings on a five-point Likert scale measuring both the importance and performance of those technological applications which they use for daily sales

responsibilities including RDS. From the 509 respondents, RDS was rated with a mean of 3.6 (3=neutral, 4=fairly important) in the importance score; however, the mean was 2.9 (2=dissatisfied; 3=neither dissatisfied/satisfied) in the performance score. RDS was well below average on the performance score in the list of technological applications rated by the hotel salespersons in this research. It was argued that the lack of follow-up training sessions could be one of the reasons causing this result, and the need for constant monitoring and updating of the systems has also been advised. The argument also echoes the study of a Finnish company conducted by Heikkilä (Rogers 2003); the research found that it was a time consuming process for employees to learn how to effectively use personal computer systems. Rogers argues that it is estimated that 20 to 25 percentage of employees' time at work plus additional considerable effort by their colleagues who help with their learning, is required for some innovations involving personal computers.

2.5 Innovation Diffusion Theory

Rogers (2003, p. 5) defines diffusion of innovation as "the process in which an innovation is communicated through certain channels over time among the members of a social system". He further describes that the messages embedded in the communication are new ideas, and the purpose of this communication is to reach a mutual understanding and to exchange information in order to achieve goals. In other words, the communication intends to reduce the uncertainty brought from the new ideas. Uncertainty, which implies a lack of predictability, could be, therefore, reduced through information exchange. Rogers and Kincaid (1981) state that information exchange effectively decreases the number of possible alternatives emerging from uncertainty. For example, the degree to which the productivity of Room Diagramming Solutions can help to improve venue management may be influenced by how well the innovation is implemented and the management staff educated within the adopting venue organisation. The better the communication and information exchange, the less the variability of the expected productivity gains will be.

Innovation Diffusion Theory has been recognised by the academic community as one of the fundamental theories used when evaluating innovation diffusion (Moore and Benbasat 1991; Tornatzky and Klein 1982; Zhu and Kraemer 2005). Rogers (2003), who gave the birth of the theory in 1962 by publishing the book entitled "Diffusion of Innovations", suggests that the major characteristics of organisational usage of an innovation could be evaluated in five intrinsic categories: 1. relative advantage; 2. compatibility; 3. complexity; 4. observability 5. trialability. The results were summed up from more than three thousand innovation diffusion publications by Rogers, and these characteristics are one of the most widely applied models of innovation diffusion research (Frank and Heikkiä 2002).

Relative advantage has been described as the degree to which an innovation can bring benefits to an organisation and may be measured in economic terms, convenience level and/or satisfaction level. The point of the measurement is not whether an innovation has a great deal of "objective advantage" such as absolute cost or sales amount; what does matter is whether an individual within the organisation perceives the innovation as advantageous. Rogers (2003) claims that as for relative advantage the perceived benefits of an innovation from adopters outrange the "objective advantage". However, relative advantage "often fail(ed) to specify the criteria for judging" (Tornatzky and Klein 1982 p. 40). It is argued that relative advantage could be measured by reduced costs, less complexity or other factors. Apart from economic terms, Rogers (2003) suggests that relative advantage could be measured in social prestige factors, convenience and satisfaction factors.

Compatibility is defined as the degree to which an innovation is perceived as being consistent with the existing business processes, practice and values. It is considered that a compatible innovation may speed up the adoption process within organisations and the diffusion of the value evoked. It is claimed that the compatibility of an innovation, as perceived by members of a social system, is positively related to its rate of adoption (Rogers 2003). Compatibility is not only a normative or cognitive characteristic concerning what people feel or think about a technology but also could be interpreted in a practical or operational view which focuses on what people do

(Tornatzky and Klein 1982). Ettlie and Vellenga (1979) include the risk-taking climate of an organisation into the definition of compatibility in their research. In the research which was conducted by Tornatzky and Klein (1982) compatibility is the most frequently cited innovation characteristic among the seventy-five reviewed articles. From its' review of relevant literature through meta-analysis, a positive direction of the relationship between compatibility and adoption of an innovation had been identified. Compatibility has also been identified in some previous research papers as being the strongest driver of innovation diffusion characteristics (Zhu et al. 2006).

Complexity has been described as "the degree to which an innovation is perceived as (being) relatively difficult to understand and use" (Rogers 2003, p. 266). If the new skills required are, because of the innovation, simple and easy to understand by individuals within organisations, it may not take long to see the full potential of the impact evoked from the innovation. It is found that complexity had been measured commonly by adopters' rating, and there is a negative relationship between the complexity of an innovation and its adoption (Tornatzky and Klein 1982).

Observability is defined as the degree to which the results of an innovation are visible to others. The high degree of visibility of an innovation may stimulate peer, customers' and stakeholders' discussion around the new ideas and make the innovation spread rapidly. The reactions could be positive or negative. Rogers (2003) believes that a high visibility of an innovation can effectively increase the interests of the potential adopters to discuss the innovation with peers. As a result, the observability of an innovation, as perceived by members of a social system, is positively related to its rate of adoption.

Trialability is described as the degree to which an innovation may be experimented with on a limited basis. A trialable innovation, which allows people to learn and test by actually practicing it, reduces the uncertainty and entry barriers to the individual or customers who are considering adoption of the innovation. It is claimed that later adopters of an innovation could have heard about it from peers who have already

adopted the innovation; as a result, trialability has been perceived as relatively more important by earlier adopters than by later adopters (Rogers 2003). Furthermore, incompatible innovations, which often require the prior adoption of a new value system, slow the diffusion process compared with divisible innovations. Divisible innovation creates a trial zone and space for potential adopters, which gives them privileges regarding the rate of adoption and implementation (Rogers 2003).

Many studies have shown interest in how the perceived characteristics of an innovation affect its rate of adoption and implementation (Beatty et al. 2001; Geoffrion and Krishnan 2003; Kearns 1992; Premkumar et al. 1994; Tornatzky and Klein 1982; Zhu et al. 2006). Rogers' five innovation diffusion characteristics have also been used to explain the failure of innovation diffusion (Kremer et al. 2001). Tornatzky and Klein (1982) conducted a meta-analysis on 75 previous articles concerning innovation characteristics and found compatibility, relative advantage and complexity were the most frequently identified evaluation factors when organisations were considering whether to adopt and to implement an innovation.

Downs and Mohr (1976) claim that innovation characteristics could be divided into primary and secondary attributes of innovations. The primary attributes can be measured in a standard manner across settings and organisational factors such as cost or size. However, the secondary attributes such as observability or trialability are commonly measured through the perceptions of adopters or professionals. Different from the primary attributes, the secondary attributes, which are influenced by varied settings and actors implementing a specific innovation, therefore, are difficult to be generalized across a large sample of organisations or geographic locations. Nevertheless, Tornatzky and Klein (1982) challenge that the primary attributes, which are asserted can be measured objectively, however, is subjective in the meanings of the measures. For example, cost is a fixed amount but is evaluated comparing with the adopters' financial resources. Thus, there can be no difference between the primary and secondary attributes as for the subjective or objective issues.

Kearns (1992), in a study of the adoption of eight computer innovations, surveyed 127 managers in Pennsylvania, USA. Twenty-five attributes of innovation diffusion of the eight innovations were identified from the respondents and explained 27 percentage of the variance in the rate of adoption of the eight innovations. Within the twenty-five attributes, the five innovation diffusion characteristics suggested by Rogers explained more than 90 per cent (Rogers 2003). The explanatory power of the theory is demonstrated.

Multivariate regression analyses were performed by Premkumar et al. (1994) in order to identify the most important predictors of implementation success on a specific innovation, Electronic Data Interchange (EDI), within 201 firms in the USA. The innovation diffusion theory was used, and relative advantage and technical compatibility were found to be the important predictors of innovation diffusion. In addition, technical and organisational compatibility was identified as the most important predictors of implementation success in EDI.

Beatty et al. (2001) surveyed 286 medium-to-large US firms and investigated the reasons behind the decisions for the adoption of the innovation of Web sites presence. Perceived benefits (relative advantage) and compatibility had received great emphasis when early adopters were making investment decisions.

Rogers (2003) claimed that computer software, which is the programs for a computer system and the software component of a technological innovation, is relatively less apparent to observation (observability) compared with the computer hardware which consists of electronic equipment.

Geoffrion and Krishnan (2003, p. 1276) consider that ICT, especially the Internet, which enables “to collect, store, process and communicate data and to interconnect individuals and organisational units in various ways” is one of the most crucial innovations in the era of the digital economy. Some businesses which use the Internet platform and ICT to conduct transitions including purchasing and selling, the so-called electronic business (eBusiness), are eager to understand the process of ICT

innovation assimilation (Zhu et al. 2006). Zhu and Kraemer (2005) suggested that actual use of ICT innovation and value creation from ICT innovation in the post-adoption stage should be explored when conducting innovation diffusion research.

2.6 The Technology-Organisation-Environment (TOE) Framework

Rogers (2003) suggests that there are other variables, apart from the five innovation diffusion characteristics, which affect its diffusion, such as the nature of the social system and the size of the system. Tornatzky and Klein (1982) conduct a statistical literature review for innovation characteristics and innovation adoption-implementation through the use of meta-analysis. Thirty different frequently addressed characteristics were identified and reviewed and these are: relative advantage, association with major enterprise, clarity of results, compatibility, communicability, complexity, continuing cost, cost, divisibility, ease of operation, flexibility, importance, initial cost, mechanical attraction, observability, payoff, pervasiveness, profitability, radicalness, rate of cost recovery, regularity of reward, reliability, riskiness, specificity of evaluation, saving of discomfort, saving of time, scientific status, social approval, trialability and visibility.

The Technology-Organisation-Environment (TOE) framework was later developed by Tornatzky and Klein (1990). It emphasizes the context of an innovation. Technological Context is defined as both the existing technologies in use and new technologies relevant to an organisation (Tornatzky and Fleischer 1990). Organisational Context could be described as descriptive measures about the organisation such as scope, size and the amount of slack resources available internally (Zhu and Kraemer 2005). Environmental Context refers to the arena in which an organisation conducts its business - its industry, competitors and dealings with government (Fuchs et al. 2010). It is believed that the contexts of the TOE framework help to strengthen what has been generally neglected in the original innovation diffusion theory such as the aspects of technological and organisational circumstances of the adopting organisation and their industries (Chau and Tam 1997). TOE framework has been closely examined as a generic theory of ICT innovation diffusion and gains consistent empirical research support in different types of ICT

innovation (Chau and Tam 1997; Fuchs et al. 2010; Iacovou et al. 1995; Thong 1999; Zhu and Kraemer 2005). Zhu and Kraemer (2005) suggested that the TOE framework, which attributes technology diffusion to internal and external characteristics of the adopted organisation, could be linked to Rogers' innovation diffusion theory, and they believe that the framework is appropriate for realizing eBusiness usage. They believe that through exploring the three aspects, technological, organisational and environmental context, identified by the TOE framework, the adoption, implementation and use of ICT innovations within the context of an organisation could be understood and monitored. The TOE framework is appropriate for studying eBusiness usage as a theoretical underpinning. It is found that in various ICT innovations such as electronic data interchange (EDI), open systems and material requirement planning, the TOE framework has been validated with empirical support and has been regarded as a generic theory for the study of technological innovation diffusion (Chau and Tam 1997; Iacovou et al. 1995; Thong 1999).

Mata et al. (1995) considered that technological competence should include both the dimensions of technology infrastructure and IT skills. It is claimed that the degree of usage of Internet technology is uneven among the adopted companies and, therefore, the value creation of eBusiness and the impact of the innovation to the adopted companies varies significantly (Currie 2004). It is believed that less effort will be needed if the Internet-adopted companies have compatible existing processes and systems when conducting business (Chatterjee et al. 2002). It is also suggested that in order to improve the usage intensity of previously adopted eBusiness applications, staff training in related ICT skills and upgrading of existing IT systems should be pursued, and professional and financial assistance should be supplied (Fuchs et al. 2010). eBusiness innovation could be viewed as a system which uses the Internet to conduct or support other business activities along the value chain (Porter 2001). Zhu and Kraemer (2005) consider that eBusiness, in which ICT innovation is used to extend basic business products and services and to streamline the integration with suppliers and customers, is a type three innovation where the whole business is potentially affected strategically. This makes eBusiness innovation diffusion

different from diffusion patterns of the other ICT innovations. Apart from being affected by technological context (i.e. technological competence of the user organisation) like the other ICT innovations such as EDI (Electronic data interchange), eBusiness innovation diffusion is also influenced by the specific organisational context (i.e. international scope) and environmental context (i.e. legal protection of online transactions over the Internet).

It is suggested that independent variables to innovation characteristics such as measures of the adopting organisations could be useful for the examination of the interaction of innovation characteristics and organisational features (Ettlie and Vellenga 1979; Tornatzky and Klein 1982). Organisational context such as structures and culture may limit or facilitate ICT innovation usage (Fletcher and Wright 1997). It is found that ICT value is affected by organisational structural differences such as organisation size and scope (Zhu and Kraemer 2005). Rogers (2003) claims that the size of an organisation, which is viewed as the summation of total resources, employees' technical expertise and organisational structure, is found to be positively related to its innovativeness. However, conflicts have been found in previous research as for the factor of organisation size to the effective use of an ICT innovation. Damanpour (1992) regarded that the factor of company size in the organisational context was unclear because of tension between the availability of resources and internal structural inertia. Rogers (2003) claimed that large organisations have more slack resources for guaranteeing the success of a new innovation implementation. However, it is found that there is a negative relationship between organisation size and the effective use of an ICT innovation in Zhu et al.'s research (2006, p. 611), and this research claims that large organisations "might be burdened by structural inertia" when facilitating effective use of an ICT innovation. Moreover, Premkumar et al. (1994) believed that eBusiness, as a specific ICT innovation, may find its usage limited because of the lack of compatibility of the adopted companies in terms of their organisational context such as culture and existing processes. Zhu et al. (2006) suggested that eBusiness vendors should assist their clients to adjust internal processes and organisational structures in order to make best use of the eBusiness technologies being adopted.

It is found that innovation diffusion is sometimes similar to a contagion effect: when an individual sees peers adopting an interactive innovation, he or she may choose to adopt it based on others' decisions (Rogers 2003). As described by Allen (1988, p. 260) , "the individual's effort to decide hinges upon 'watching the group' - the other members in the community of actual/potential subscribers - to discern what the group choice may be...The outcome for the group then turns literally upon everybody watching while being watched". Markus (1987, pp.495-496) describes the influence of the critical mass to the innovation diffusion in an opposite way: "as users defect, the benefits of the remaining users will decrease and the costs will increase, thus stimulating further defection". Rogers (2003) suggests that for some innovation adopters the peers or "neighbours" within the same social structure may play a more important role than the innovation promoters in the processes of innovation diffusion. In a social system, which could be viewed as a kind of collective learning system, the early adopters may have to transmit their experience of an innovation, no matter positively or negatively, to the peers within the same social structure through interpersonal networks. This may determine the rate of adoption or the patterns of implementation of the innovation in a social system. The members within the same social system who have a high degree of homophily, which is the degree to which individuals who communicate are similar, may spread an innovation rapidly through interpersonal diffusion networks. It is claimed that when more and more individuals in a social system adopt a specific ICT innovation, the innovation may "be regarded as progressively beneficial to both previous and potential adopters", the so-called critical mass theory (Lee et al. 2013, p. 10). As perceptions of the innovation improve, the increased collective adoption may be observed.

In Zhu et al.'s research (2006), it is found that effective use of ICT innovation in the adopted organisations could rely on the usage extent of a cluster of their value chain partners. Improved company performance may be evoked through the enriched information flow and the strengthening of online integration with business partners. Premkumar et al. (1997) believe that in order to use ICT innovations such as online transactions in daily business activities, the trading partners of the adopted

companies require to install compatible ICT infrastructures. Furthermore, Porter (2001) believed that ICT innovation enables a company to compete in an extended market and to trade with a broader range of business partners. Teo et al. (2003) considered that as for the environmental context, the factors representing horizontal competitors and vertical trading partners should be included. “By adopting IS (Information Systems), firms might be able to alter the rules of competition, affect the industry structure, and leverage new ways to outperform rivals, thus changing the competitive environment” (Zhu et al. 2003, p. 256). It has also been found that ICT innovation usage is affected by the local economic environment and regulatory factors of the adopted organisations (Zhu and Kraemer 2005). It is claimed that the context of the social system such as hierarchy, reward systems and regulations can be one of the important attributes for innovation diffusion and, through the critical mass, may create pressure for its members to adopt and implement an interactive innovation (Rogers 2003). In Zhu and Kraemer's research (2005), competitive pressure and regulatory support were rated as the most important antecedents of eBusiness use in the factor tier of external environmental context. It is found that companies in the developed countries are affected by competitors’ ICT development because of the transparency of information in their business environment.

Iacovou et al. (1995) used the TOE framework to investigate the adoption of the Electronic Data Interchange (EDI) for small businesses through seven case studies. The factors that influence the adoption behaviour and impact of the EDI were identified: organisational readiness, external pressure and perceived benefit. Kuan and Chau (2001) employed the TOE framework to study the adoption of EDI by using the definitions of the technological context as perceived technological benefits; the organisational context as perceived organisational resources; the environmental context as perceived environmental pressure. A perception-based model was proposed and tested through a survey of 575 small companies in Hong Kong. Perceived direct benefits, perceived indirect benefits, perceived financial cost, perceived technical competence and perceived government pressure were identified as the distinguishing factors that could influence the adoption behaviour in this study.

Chau and Tam (1997) revised the TOE framework as the technological context referring to the cost and benefit; the organisational context indicated the degree of the coordination between current technological settings and the characteristics of the innovation; the environmental context was represented by the variables of the market uncertainty and competition in the industry. In-depth interviews were conducted with senior executives from 89 organisations to discover their thoughts on the factors that may affect the adoption of open systems. The variables of barriers to adoption and satisfaction with existing systems were identified as the influential factors to the open systems adoption.

Zhu et al. (2003) used the TOE framework to assess eBusiness value creation at the company level across countries. 612 companies across ten countries were surveyed, and the structural equation model was used to manage the data collected. The factors of technological integration, financial resources, firm scope, firm size, regulatory environment and government regulation were identified as the important variables for the value creation process of eBusiness to the adopted companies.

Zhu et al. (2004) surveyed 612 firms across ten countries in the financial services industry for the development of an assessment model of eBusiness value. In their research, it is found that internal organisational dimensions (technological and organisational contexts) are more important than external dimensions (environmental context such as competitive pressure). It is found that the factors in the technological context of the TOE framework are the strongest ones. As for the factors within the organisational context, financial resources and global scope are identified as important factors. The factor of the regulatory environment demonstrates there is a significant contribution to the environmental context. However, among the factors tested, the factor of firm size is negatively related to eBusiness value.

Through surveying high-level managers in 624 firms of the retail industry across ten countries, Zhu and Kraemer (2005) develop an assessment model for the consequences of an ICT innovation diffusion (eBusiness) at the company level through the application of an integrative model. The suggested model was tested by

means of structural equation modelling. From the results of this research it is claimed that three types of antecedent developed from the TOE framework could be used to monitor the actual usage of an ICT innovation: technological factors, organisational factors and environmental factors. Firm size and financial commitment were rated as the most important antecedents of eBusiness use in the factor tier of organisational context in their research results.

Fuchs et al. (2009) conducted survey research among managers of 723 Austrian hotels. The TOE framework (Tornatzky and Fleischer 1990) and the ICT-Value framework (Zhu and Kraemer 2005) were used for the construction of a model being proposed to determine the business performance of the hotels after the adoption of eBusiness applications. Family-owned hotel businesses were targeted in their research as a type of company with regard to the organisational related context of their integrated model. The suggested model was tested by means of structural equation modelling. From the results of this research it is found that managerial support and positive ICT experiences are the main usage determinant for five eBusiness applications (enterprise resource planning, yield management, customer relationship management, personal information and online procurement systems). Furthermore, stakeholder pressure which was measured by tourists' and cooperation partners' ICT needs is the main usage determinant for the eBusiness applications of Email marketing, Intranet, property management systems, websites with booking functionalities and distribution via online booking platforms.

Fuchs et al. (2010) explain that the indicators emerging from the TOE framework reveal technological, economic and social infrastructure of the ICT innovation adopting companies. The technological infrastructure could be evaluated through the availability of Internet access, W-LAN technologies and so on; the economic infrastructure concerns resources to cover implementation and operational costs of the ICT innovation adoption; ICT skills, the perceived pressure from business partners and other factors could be used to evaluate the social infrastructure. In their research from the perspectives of the surveyed Destination Management Organisation (DMO) managers, ICT infrastructure and the environmental context

such as using new technologies to remain competitive and tourists expectations of the latest ICTs were recognised as factors reflecting usage of the eBusiness applications and behind the value creation processes at the DMO in their linear structural equation models. It is found that in the post-adoption phases predominantly environmental and technical issues become crucial.

Various ICT innovations research has used the TOE framework as a generic theory for the study of technological innovation diffusion as shown in Table 7.

Table 7 – TOE Framework Literature

Literature	Information System Domain
Cooper and Zmud (1990)	Material Requirements Planning (MRP)
Iacovou et al. (1995)	Electronic Data Interchange (EDI)
DePietro et al. (1990); Thong (1999)	Information Systems
Kuan and Chau (2001)	Open Systems
Zhu and Kraemer (2002)	e-commerce
Zhu et al. (2003, 2004, 2005, 2006)	eBusiness
Pan and Jang (2008)	Enterprise Resource Planning (ERP)
Fuchs et al. (2009)	eBusiness applications used in hotel businesses: Property Management System (PMS); Enterprise Resource Planning System (ERP); Yield Management System (YMS); Intranet (INTR); Costing & Accounting System (CAS); Electronic Customer Relationship Management System (eCRM); E-Mail-Marketing (e.g. newsletters) (EMM); Personnel Information System (PIS); Websites with booking functionality (WBOOK); Online Procurement (PROC); Online Platforms (OPLA)
Fuchs et al. (2010)	eBusiness applications used in the Destination Management Organisations: Destination Management System (DMS); Customer Database (CDB); Electronic Customer Relationship Management System (eCRM); Enterprise Resource Planning System (ERP); Personnel Information System (PIS); Costing and Accounting System (CAS); Web sites dedicated to information provision only (WEB); Web sites with booking functionality (WBOOK); E-mail Marketing (e.g., newsletters) (EMM); Online procurement (PROC); Extranet connectivity (e.g., with authorized suppliers) (EX-NET)
Ifinedo (2011)	Internet/eBusiness

2.7 Assessment of the Adoption of ICT

Since the 1980s information technology productivity has been highlighted in academic circles as an issue worthy of debate (Bresnahan et al. 2002; Solow 1987). This productivity has been measured by factors surrounding inputs and outputs which are derived from production processes. The spectrum of examination for the productivity has for decades run across macroeconomics through to microeconomics and also across industries (Brynjolfsson and Hitt 2003; Ham et al. 2005). Previous research shows that there is productivity gain arising from investment in ICT; however, it has also been argued by people with other points of view that there is a hypothesis called the "ICT Productivity Paradox" (Brynjolfsson and Adam 2010).

The computer productivity paradox was debated heavily in the 1980s and the 1990s. Professor Robert M. Solow, winner of the 1987 Nobel Prize in Economics, quipped in a book review article, "You can see the computer age everywhere but in the productivity statistics" (Solow 1987, p. 36). The first Personal Computer was created in 1973; scholars claimed that in 1973 to 1995 the average annual U.S. labour productivity growth rate was 1.4 percentage. There is no improvement shown on the rate comparing with the average rate of 2.7 percentages in 1948 to 1972. Thus, the computer productivity paradox could be described as a question: "why would firms invest so heavily in technology for decades if there wasn't a measurable effect on productivity?" (Brynjolfsson and Adam 2010, p. 41). For decades, economists have investigated the discrepancy between measures of investment in ICT and measures of ICT's contribution (Wetherbe et al. 2007).

Brynjolfsson and Hitt (2003) have argued that ICT investment tangibly and intangibly contributes to and facilitates incremental company performance and productivity. The benefit is beyond that of the general financial accounting concept of the Return on Investment (ROI), especially from a long-term perspective. The ICT productivity outcomes have been considered in three main dimensions: economic growth; labour productivity; consumer welfare (Brynjolfsson and Hitt 1996). Go (1992) and Buhalis (1998) believe that ICT also helps organisations to achieve strategic gains through flexible pricing, reduced communication and distribution

costs, more specialized and differentiated services, close relationships with customers and smart enterprise networks. Sethi and King (Sethi and King 1994) believe that an efficiency impact could be observed from the increased labour productivity. It is also considered that the transaction cost efficiencies are one of the values created by ICT productivity; the efficiencies come from the reduced uncertainty, complexity and information asymmetries (Shapiro and Varian 1999; Wu et al. 2003).

Internet technological innovation, which is characterized by open standard, public access, global connectedness, real-time communication and broad connectivity, has influential impacts on customer reach and richness of information (Bakos 1990; Fuchs et al. 2010; Shapiro and Varian 1999). The characteristic of open standards of Internet innovation enables business partners to work on a platform which facilitates the sharing of information along the value chain. A better synchronized information flow could be built and implemented. Zhu and Kraemer (2002) claim that the global connectedness of the Internet technological innovations improve company performance by means of reaching out to new markets and attracting new customers. The Internet breaks the geographic boundaries of global reach to potential customers by means of cost-efficient connections (Steinfield et al. 2002). The market expansion which benefits from the use of Internet innovation may increase transactional efficiencies in the adopted organisations due to the economies of scale (Zhu and Kraemer 2005). The improved relationships among suppliers and business partners are also a benefit gained from this advantage. The Internet creates a platform which allows a two-way real-time information exchange among the adopted companies, their customers and their business partners. The reduction of information asymmetry and market friction is one of the values created by the use of Internet innovation (Zhu 2004b). The adopted organisation could use the value created to broaden information reach and to widen the richness of market information.

Resulting from characteristics of the Internet such as open-standard connectivity and public networks, Zhu and Kraemer (2005) categorized the value of eBusiness to the adopted organisations in three categories: market expansion; information sharing;

value-transactional efficiencies. It is claimed that eBusiness, which integrates information systems with the core business processes of the adopted company, potentially affects the whole business and its strategies. The new business networks brought from the adoption of eBusiness lead to the creation of economic scale and scope (Shapiro and Varian 1999). The basic business products and services could be extended, and customers and suppliers could be aligned through the use of eBusiness. Taking advantage of the use of Internet platform, ICT innovation and eBusiness transformed the traditional approaches of communication such as paper-based work or phone communication, the physical processes in inter-company value chain activities. Digital assets and information flow are now playing crucial roles in value creation processes (Zhu et al. 2006). Barua et al. (2004) believe that adopting eBusiness may help the adopted companies to improve coordination with suppliers and to increase operational efficiencies. Reduced uncertainty, complexity and information asymmetries could be generated and lead to improved efficiency gains such as decreased transaction costs (Wu et al. 2003). It is claimed that cost savings due to improved efficiency could be divided into internal and external parts (Lucking-Reiley and Spulber 2001). Internal savings arise from improved operations and administrative processes; improved approaches to the coordination of customers, suppliers and other stakeholders lead to external savings. Furthermore, it is claimed that the capabilities of transferring huge amounts of data and real-time connection enable eBusiness to improve the quality of relationships with business partners in the adopted companies (Xu et al. 2004). Colecchia (1999, p. 4) explained that the improved company performances could be described as “the differences made by e-Business applications in terms of efficiency or the creation of new sources of wealth”. Zhu et al. (2006, p. 602) defined eBusiness impact as “the impact of eBusiness use on firm performance”. eBusiness impact could be evaluated through the strategic benefits and operational benefits which it brought in.

In tourism and hospitality literature, ICT investment has been regarded as an important element for continuous business successes (Buhalis et al. 2011). This ICT productivity contribution is considered particularly in four areas: refining customer service; improving operations; increasing revenues; minimizing costs (Barcheldor

1999; Huo 1998; Sweat and Hibbard 1999). Ricci (2002) described that because of the reduced time required to reach customers through the Internet and the useful information provided to help in customers' decision-making processes in the tourism and hospitality sector, eBusiness may impact on customer satisfaction of the adopted companies. Ham et al. (2005) found that from the employees' perspective ICT productivity contribution is shown in revenue generation, customer service improvement and cost reduction. A study sponsored by the Hospitality Information Technology Association and the Hospitality Technology Magazine identified productivity improvement, enhanced guest services, revenue generation opportunities, cost reduction/savings and competitive pressure as the key driving forces for implementing information technology in the lodging industry (Third Annual Lodging Industry Technology Study 2004). However, it is believed that ICT investments may not lead directly to improved company performance unless "certain prerequisites are satisfied, namely long term planning, innovative business processes re-engineering, top management commitment and training throughout the hierarchy" (Buhalis 1998, p. 410).

In Fuchs et al.'s research (2009) a dedicated indicator framework for eBusiness adoption measurement with an extended impact measurement has been developed. This framework considers that ICT productivity comes from the growths brought about, efficiency gains and quality improvements in stakeholder relationships. Fuchs et al.'s study (2010) has extended their spectrum of the contribution of ICT to infrastructural, organisational and environmental effects. Their study is mainly grounded in the Innovation Diffusion Theory (Rogers 2003), the economic effects model (Hollenstein 2004) and in the eBusiness impact model (Zhu and Kraemer 2005). The eBusiness Intensity-Readiness-Impact Framework used by Fuchs et al. (2010, p. 169-170) categorizes ICT productivity impact into four areas: impact on sales; impact on efficiency; impact on business partner relationships; impact on customer satisfaction. In the event management research domain, Lee et al. (2013, p. 8) claim that ICT applications may help event planners to "fulfil their primary goal to produce a meeting that meets a client organisation's goals" and enable the client to better understand the value and service that the planners add to events.

Through this review of relevant literature, the author discovered that these studies appear to have some similarities to ICT value/impacts on economic sustainable corporate performance. Table 8 summarises views from the previous scholars' studies on this topic by three major categories: sales, costs and relationships.

Table 8 – ICT Value Categories on Economic Sustainable Corporate Performance

<table>
<tr><th>Literature\ICT Value</th><th>Sales</th><th>Costs</th><th>Relationships</th></tr>
<tr><td>Brynjolfsson and Hitt (1996)</td><td>Economic growth</td><td>Labour productivity</td><td>Consumer welfare</td></tr>
<tr><td rowspan="2">Buhalis (1998) ; Go (1992)</td><td>Flexible pricing</td><td rowspan="2">Reduced communication and distribution costs</td><td>Close relationships with customers</td></tr>
<tr><td>More specialized and differentiated services</td><td>Smart enterprise networks</td></tr>
<tr><td rowspan="3">Shapiro and Varian (1999); Wu et al. (2003)</td><td rowspan="3"></td><td colspan="2">Reduced uncertainty</td></tr>
<tr><td colspan="2">Reduced complexity</td></tr>
<tr><td colspan="2">Reduced information asymmetries</td></tr>
<tr><td rowspan="2">Bacheldor (1999); Huo (1998); Sweat and Hibbard (1999)</td><td rowspan="2">Increasing revenues</td><td>Improving operations</td><td>Refining customer service</td></tr>
<tr><td colspan="2">Minimizing costs</td></tr>
<tr><td>Ham et al. (2005)</td><td>Revenue generation</td><td>Cost reduction</td><td>Customer service improvement</td></tr>
<tr><td>Zhu and Kraemer (2005)</td><td>Impact on sales</td><td>Impact on internal operations</td><td>Impact on procurement</td></tr>
<tr><td>Zhu et al. (2006)</td><td>Downstream Sales</td><td>Internal Operations</td><td>Upstream Coordination</td></tr>
<tr><td>Fuchs et al. (2009)</td><td>The growths brought about</td><td>Efficiency gains</td><td>Quality improvements in stakeholder relationships</td></tr>
<tr><td rowspan="2">Fuchs et al. (2010)</td><td rowspan="2">Impact on sales</td><td rowspan="2">Impact on efficiency</td><td>Impact on business partner relationships</td></tr>
<tr><td>Impact on customer satisfaction</td></tr>
</table>

Researchers have used diverse approaches to try to confirm the relationships between ICT investment and the related outputs from the investment. However, the research results show varied conclusions. Firstly, the different items of ICT investment may be associated with different degrees of productivity; it has been argued that the

current evidence from research is not strong enough to demonstrate their productivity or the evidence is uneven in different research projects (Ham et al. 2005). Rogers (2003) argues that to consider all innovations as equivalent units by ignoring the characteristics of each one oversimplifies the innovation differences.

Secondly, similar items of ICT investment used in different geographic areas and organisations seem to result in varied productivity; it has been claimed that the level of ICT productivity could vary according to how organisations and users implement the items which have been invested in their business processes (Bresnahan et al. 2002; Brynjolfsson and Adam 2010; Pilat 2004; Scholochow et al. 2010; Shang et al. 2008). It is claimed that cultural and economic factors across different countries may affect the presumption of conceptual equivalence in management science research (Rosenzweig 1994). In Zhu et al.'s research (2004), it is found that in developed countries, technological capabilities are far more important than factors of financial resources when assessing the value of eBusiness at the firm level. Zhu and Kraemer (2005) found that economic and regulatory factors may affect the consequence of technology diffusion across different countries.

Thirdly, according to Brynjolfsson and Hitt (2003) there is a significant time lag between the observed contribution of computerization and time-consuming ICT investment and the related investment of complementary inputs. It has been claimed that the U.S. labour productivity growth in 1996 to 2003 benefited from the heavy investment in ICT in the 1990s and the drop in ICT investment in 2001 to 2003 may have caused the decline in productivity growth rate in 2004 to 2006; scholars argue that insufficient or inappropriate consideration for the time-lag factor leads to the fallacious conclusion where the phenomenon of ICT productivity paradox arises (Brynjolfsson and Adam 2010).

As a result, many researchers have left the debate on the ICT productivity paradox aside and have devoted their research focuses to the exploration of different statistical approaches for measuring and giving evidence of ICT productivity in varied industries and subsectors (Keramati 2007; Scholochow et al. 2010). Some

tactics have been developed to include invisible outputs induced by ICT investment. Brynjolfsson and Hitt (2003) suggest that customers' perceptions should be included in the measurement of ICT productivity, because they can recognise and value these benefits. As a result, researchers have worked on the development of dedicated quantitative frameworks to measure ICT productivity, and the indicators used to account for these frameworks come from both subjective (internal managers' perspectives; external customers' perceptions) and objective data (statistical information).

Rogers (2003) argues that the adopters of an innovation are seldom certain there will be obvious gains from the adoption; however, further evaluative information about its effects will be helpful to provide a relatively clear viewpoint. The Technology Acceptance Model (TAM) which was suggested by Davis (1993) was widely adopted in the research vein of the adoption behaviour of decision makers. The adoption research focuses on behavioural aspects of the adopting individual: for example, the research conducted by Lee et al. (2013) focuses on the exploration of meeting planners' use of social network media and the impact of perceived critical mass. However, Arpaci et al. (2012) argue that the TAM model is mainly used at the individual level and perspective rather than at the organisational level and perspective. It is also claimed that post-adoption evaluation should be followed up (Zhu and Kraemer 2005). In the post-adoption stage decision makers are specifically concerned about the economic impact and effectiveness generated from the adoption of ICT innovation (Fuchs et al. 2009). Accompanied by the continuous development of ICT, rich functionality has continued to grow and added to a specific ICT innovation. In order to track the very dynamic developments of the specific ICT innovation in the adopting organisation a tailored evaluation framework should be built (Chau and Tam 1997; Colecchia 1999; Zhu et al. 2006).

Furthermore, the outputs induced by ICT investment could be linked to the Innovation Diffusion Theory developed by Rogers (Fuchs et al. 2009; Zhu and Kraemer 2005). Rogers and Shoemaker (1971, p. 173) define relative advantage as "the degree to which an innovation is perceived as being better than the idea it

supersedes" and may be "expressed in economic profitability, but the relative advantage dimension may (also) be measured in other ways". Miller (1957) argued that relative advantage (or in his word: effectiveness) should be demonstrated based on mathematical and experimental means. Martino et al. (1978) evaluate the relative advantage by using profitability, productivity and reduced labour requirements. Tornatzky and Klein (1982) argue that relative advantage is too broad and amorphous as a characteristic and should be redefined by specific measureable characteristics. The relative advantage of an innovation was also described as "a ratio of the expected benefits and the costs of adoption of an innovation" (Rogers 2003, p. 233). He suggests that the degree of the advantage brought by ICT investment may be expressed as economic profitability, low initial cost, a decrease in discomfort, increased social prestige, a saving of time and effort, immediacy of reward or the other characteristics of the adopters.

In Tornatzky and Klein's meta-analysis research (1982) into seventy-five articles pertaining to innovation characteristics, 46.7% of the studies considered merely one characteristic, which restrains the potential comparison analyses among the various characteristics such as the relative predictive or explanative power of individual characteristics. It is also claimed that the demonstrable relative advantages of an innovation are not sufficient to guarantee the success of its diffusion and adoption (Rogers 2003). A comprehensive dedicated framework which values ICT investment could help decision makers to monitor their management. However, previous studies have shown that the components of the evaluation frameworks tend to vary among organisations or investment items due to the heterogeneity of companies, industries and geographic locations (Zhu and Kraemer 2005). Moreover, as Brynjolfsson and Hitt (2003) mention in their study, computerization "may be more strongly correlated with economy-wide changes in output". It could be expected that a growing number of output measurements will be considered in the framework agenda, such as: the issues of ICT contribution to environmental sustainability; ICT benefits to organisation branding; organisation transformation induced by ICT investment (Boston Consulting Group 2010; Brynjolfsson and Adam 2010).

Fichman (2000) suggested that ICT innovation diffusion should be viewed as a multi-stage process: the adoption and usage and value creation. It is claimed that following the adoption decision and implementation of an innovation, in the confirmation stage, recognition of the benefits of using the innovation, integration of the innovation into one's ongoing routine and promotion of the innovation to others could be the major behaviours of the innovation adopters (Rogers 2003). It is believed that the innovation diffusion theory suggests that the usage of the adopted innovation has a strong linkage with the impact made by that innovation in the adopting organisations (Zhu et al. 2006). Before the innovation is widely used in value-chain activities, the value and improved performance would be difficult to observe in the adopting companies. It is claimed that the value of ICT innovation in an organisation depends on the extent to which the innovation is used in the key activities in the organisation's value chain (Zhu and Kraemer 2005). The resource-based theory, which believes that the value created by ICT innovations is determined by the usage of the ICT innovations rather than the technologies themselves, is used as the theoretical underpinning for this claim and relevant research (Amit and Zott 2001; Ross et al. 1996). It is claimed that from the resource-based view of strategy the adoption of the Internet could strengthen the resource stock of the adopting companies strategically (Porter 2001). The uniqueness thus created blocks imitation by their competitors. However, the ICT innovation applications have to be effectively combined and used. Zhu (2004a) states that the usage of the ICT innovations in an organisation could determine the degree to which the unique capabilities are developed by the organisation from its ICT infrastructure. The greater the use and integration of a specific ICT innovation in the adopting organisations, the more likely it is that the organisations may maximise the capabilities of their ICT infrastructure, which is mainly composed of computers, networks, databases and communication platforms. The level of the integration of these components may shape the competitive advantages of the adopting organisations from a strategic point of view. The capabilities of integrating the components of ICT innovations and the abilities to orchestrate the internal resources in the organisation, therefore, are the unique value created which could not be easily imitated by other competitors. The created value depends on whether the ICT use "is

appropriate to the key activities and environment" of the organisation (Zhu and Kraemer 2005, p. 64).

Devaraj and Kohli (2003) believe that ICT value may be realised through the exploration of the actual usage of the innovation adoption. In the post-adoptive phases it is believed that usage intensities of the ICT innovation applications correspond to the creation of new sources of wealth in the adopting companies (Fichman 2001). It is found that ICT value should be linked with the actual ICT usage of the adopting organisations in order to correctly capture improved organisational performance (Zhu and Kraemer 2005). The unified perspective may demonstrate a holistic picture of the post-adoption economic value and effectiveness of ICT investment. It is also suggested that developing a practical model for monitoring the post-adoption performance of ICT innovation may significantly influence the way organisations approaching ICT investment and management (McKinsey & Company 2002). A framework for managers to monitor and to assess the conditions of ICT innovation and the ensuing progress is useful for better pursuing ICT value.

Zhu and Kraemer (2002) believe that the difficulty of collecting data is one of the major reasons why empirical evidence for the development of measures for ICT usage is seldom found. Due to the lack of appropriate measures, the impact of ICT on company performance and the extent of its usage are hard to prove. However, some previous research found that there may be positive relationships between ICT usage and improved company performance (Fuchs et al. 2010; Sigala et al. 2004; Wu et al. 2003). The propensity of ICT usage in an organisation should be taken into account when developing a framework for monitoring a specific ICT innovation. The TOE framework, which was developed by Tornatzky and Fleischer in 1990, considers specific technological, organisational and environmental circumstances, and is a useful start point for the development. It is claimed that the TOE framework is consistent with the innovation diffusion theory developed by Rogers, and through combination of the two theories, both the internal and external characteristics of a

specific ICT innovation diffusion within an organisation could be considered systematically (Zhu and Kraemer 2005).

2.8 Lack of Assessment of Post-Adoption of RDS

There is a gap in the assessment studies of the adoption of Internet RDS within both meeting and event and eTourism literature. To the author' best knowledge, only limited previous studies include RDS within their research on eBusiness applications (Jones and Baloglu 2006; UNLV 2001). However, previous general eBusiness/ICT evaluation research has provided models by which to explore the outcome and effectiveness of RDS usage. In Fuchs et al.'s research (2009) a designed indicator framework for eBusiness adoption measurement with an extended impact measurement has been developed according to the Innovation Diffusion Theory (Rogers 2003) and the eBusiness impact model (Zhu and Kraemer 2005). This framework considers that ICT's economic value comes from impact on sales, impact on efficiency, impact on business partner relationships and impact on customer satisfaction. These categories show similarities with other relevant literature on ICT value/impacts to successful corporate performance (Barcheldor 1999; Brynjolfsson and Hitt 1996; Buhalis 1998; Go 1992; Ham et al. 2005; Huo 1998; Shapiro and Varian 1999; Sweat and Hibbard 1999; Wu et al. 2003).

O'Connor and Frew (2004) argue that ICT evaluation is complex and multi-faceted and suggest that a broad range of factors should be taken into account in an evaluation process. It is claimed that there is a degree of correlation between the effectiveness of ICT and the extent of ICT being used to conduct value chain activities (Fuchs et al. 2010; Scholochow et al. 2010; Wu et al. 2003; Zhu and Kraemer 2005). Rogers (2003) suggests that the major characteristics of an innovation in organisations could be evaluated in five categories: relative advantage; compatibility; complexity; observability; trialability. He claims there is a close relationship between an innovation and the way it is used and accommodated. The innovation diffusion theory regards that the organisational usage of an innovation can be understood and monitored by its characteristics (Zhu et al. 2006). Zhu and Kraemer (2005, p. 67) use Rogers' Innovation Diffusion Theory as a key basis to

investigate post-adoption variations in eBusiness usage which is defined as “the extent to which eBusiness is being used to conduct value chain activities” including those in the frontend (selling) and in the backend (procurement).

In addition, Tornatzky and Fleischer (1990) believe that organisational usage of a technological innovation may be influenced by three aspects: Technological context; Organisational context, and Environmental context, the so-called TOE framework. It is also claimed that there is a link between ICT value and the actual usage of ICT (Devaraj and Kohli 2003). Zhu et al. (2006) argue that ICT innovation has to be used extensively throughout value-chain activities within the adopted companies before its value and impact can be realised. They and many scholars such as Grandon and Pearson (2004) have integrated this TOE framework into the measurement of ICT usage as supplements for their research. It is claimed that the TOE framework, to some extent, supports and strengthens the Innovation Diffusion Theory especially in the perspectives of technological and organisational circumstances of a potential ICT adopter and its industry (Zhu et al. 2006). Thus, through monitoring the effective usage of ICT adoption, ICT value could be realised (Fichman and Kemerer 1997).

Zhu and Kraemer (2005) develop an assessment model for the consequences of an ICT innovation diffusion (eBusiness) at the company level through the application of an integrative model. The model could be used to monitor the actual usage of and value created by eBusiness applications at the post-adoption stage. Through surveying high-level managers, 624 firms across 10 countries in the retail industry which had already adopted eBusiness were included in this research, and the suggested model was tested by means of structural equation modelling. It is believed that actual usage of the ICT innovation is the most critical factor affecting the value creation and the economic impact on the adopting organisation. From the results of this research it is claimed that three types of antecedents developed from the TOE framework could be used to monitor the actual usage of an ICT innovation: technological factors, organisational factors and environmental factors. The sub-categories (factor tiers) of technology competence, firm size, financial commitment,

competitive pressure and regulatory support were recognised in this study as important antecedents of eBusiness use.

Lee et al. (2013) believe that an integrated or extended model may provide more explanatory power than the single or original model alone. It is claimed that the impact and post-adoption innovation diffusion can be better understood through a model which combines the innovation characteristics and the TOE framework (Zhu et al. 2006). Zhu et al.'s research bridged the gap in most previous studies in the literature which focused on either innovation characteristics or TOE framework factors but not on both. In their research through surveying ICT investment decision makers in industry sectors covering manufacturing, retail/wholesale distribution and service sectors in six European countries, compatibility, relative advantage, costs, security concerns, technology competence, partner readiness, competitive pressure and organisation size are the factor tiers which have significant relationships with eBusiness and could be used to detect its usage in the adopting companies. Among all tested innovation characteristics and the TOE factors in Zhu's model, compatibility is the most important readiness and is even stronger than relative advantage. The usefulness of the innovation diffusion theory and of the TOE framework were also examined and proved to be a quality starting point for identifying factors that affect the usage of a specific ICT innovation.

Fuchs et al. (2009) conducted survey research among managers of 723 Austrian hotels. The TOE framework (Tornatzky and Fleischer 1990) and the ICT-Value framework (Zhu and Kraemer 2005) were used for the construction of a model being proposed to determine the business performance of the hotels after the adoption of eBusiness applications. Supplier relationships, marketing costs and procurement costs were ranked as the relatively strong economic impacts generated by the adoption of eBusiness. eBusiness in the hotel sector was divided into eleven applications in Fuchs's research (Property Management System; Enterprise Resource Planning System; Yield Management System; Intranet; Costing & Accounting System; Electronic Customer Relationship Management System; E-Mail-Marketing; Personnel Information System; Websites with booking functionality; Online

Procurement; Distribution via Online Platforms). In the surveyed hotels, distribution via online platforms, email marketing and online procurement were the most often adopted eBusiness applications. It could be argued that due to the wide usage of distribution via online platforms, email marketing and online procurement applications in the surveyed hotels, marketing costs and procurement costs, therefore, were identified as the most important economic impact factors. However, in this research from the perspectives of the managers of the 3-star hotels surveyed, guest satisfaction and the quality of business partner relationships did not show sufficient evidence of improvement through the adoption of eBusiness in their linear structural equation models; however, 4-star hotel managers believed the importance of these two impacts. In the eBusiness applications of Costing & Accounting System, eCustomer Relationship Management, Yield Management System, Distribution via Online Platforms and Online Procurement, the improved business partner relationships were validated from the perspectives of the 4-star hotel managers, and improved guest satisfaction was detected in Enterprise Resource Planning System. Fuchs et al. (2010) suggested that the integrated eBusiness indicator framework should be further tested and improved in other sectors of the tourism and hospitality industry.

The integrated models of the TOE framework and the innovation diffusion theory have been used in some previous research concerning the adoption of information systems (Chong et al. 2009; Lee 1998; Thong 1999; Vaidya and Nandy 2004), but in only a few papers concerning the monitoring at the post-adoption stage (Zhu et al. 2006). A summary table of some relevant literature can be seen in Table 9.

Table 9 – The Studies that Combine TOE Framework with the Innovation Diffusion Theory

Literature	Information System Domain
Chong et al. (2009)	Collaborative Commerce
Zhu et al. (2006)	eBusiness
Vaidya and Nandy (2004)	eBusiness
Thong (1999)	Information Systems
Lee (1998)	Internet-Based Financial EDI

Source: Adapted for this research from Arpaci et al. (2012)

2.9 Lack of Repeatable, Multiple and Tailored-made Measures Approaches for the Assessment of Post-Adoption of RDS

Some research studies have suggested that the adopters of an innovation still seek information and reinforcement after the innovation decision has been made (Mason 1962; Rogers 2003). However, it is argued that the adopters tend to selectively seek only information that will support a decision already made because of the personal internal requirement in order to justify and stabilise the original decision (Rogers 2003). There is a need to develop viable measures of degree of implementation for an ICT innovation. Tornatzky and Klein (1982) suggest that for the innovations with non-unitary or more complex characteristics, the key features or aspects of the innovations should be considered in the measures of implementation.

Furthermore, it is suggested by Rogers (2003) that with some innovations having the feature of re-invention by adopters or developers, which is defined as the degree to which an innovation is changed or modified by users or developers in the process of adoption and implementation, continuous and consistent measures are required. Through the literature review of this chapter, it is learnt that RDS, which is a computer software innovation, is changing and re-inventing greatly due to the fast pace of ICT technology development. Therefore, it is crucial to develop a continuous and consistent measuring system for the monitoring of the economic effectiveness of RDS in event venue management.

2.10 Summary

The literature review conducted in this chapter identified several research gaps. Firstly, it was found that specific studies concerning Room Diagramming Solutions (RDS) are sparse (Jones and Baloglu 2006; UNLV 2001), and to the author's best knowledge, there is no published academic article focusing on the economic value and effectiveness of RDS in the event management domain. Even the definition of RDS was sometimes varied in relevant academic textbooks, commercial reports or journal articles, because rich functionality has continued to grow in the RDS domain due to the continuous development of ICT.

Secondly, accompanied by the continuous development of ICT, rich functionality has continued to grow and added to a specific ICT innovation. In order to track the very dynamic developments of the specific ICT innovation in the adopting organisation a tailored evaluation framework should be built (Chau and Tam 1997; Colecchia 1999; Zhu et al. 2006). Devaraj and Kohli (2003) believe that ICT value may be realised through the exploration of the actual usage of the innovation adoption. Innovation Diffusion Theory has been recognised by the academic community as one of the fundamental theories used when evaluating innovation diffusion (Moore and Benbasat 1991; Tornatzky and Klein 1982; Zhu and Kraemer 2005). These characteristics are one of the most widely applied models of innovation diffusion research (Frank and Heikkiä 2002).

In addition, Rogers (2003) suggests that there are other variables, apart from the five innovation diffusion characteristics, which affect its diffusion, such as the nature of the social system and the size of the system. The Technology-Organisation-Environment (TOE) framework was later developed by Tornatzky and Klein (1990). It emphasises the context of an innovation. It is believed that the contexts of the TOE framework help to strengthen what has been generally neglected in the original innovation diffusion theory such as the aspects of technological and organisational circumstances of the adopting organisation and their industries (Chau and Tam 1997). Lee et al. (2013) believe that an integrated or extended model may provide more explanatory power than the single or original model alone. It is claimed that the TOE framework is consistent with the innovation diffusion theory developed by Rogers, and through combination of the two theories, both the internal and external characteristics of a specific ICT innovation diffusion within an organisation could be considered systematically (Zhu and Kraemer 2005). Fuchs et al. (2010) suggested that the integrated framework should be further tested and improved in other sectors of the tourism and hospitality industry.

Thirdly, Zhu and Kraemer (2002) believe that the difficulty of collecting data is one of the major reasons why empirical evidence for the development of measures for

ICT usage is seldom found. Due to the lack of appropriate measures, the impact of ICT on company performance and the extent of its usage are hard to prove. There is a need to develop viable measures of degree of implementation for an ICT innovation. Thus, this research is dedicated to the development of a practical indicator system to help decision makers to monitor the economic value and effectiveness of their post-adoption of ICT investment. The results of this research may also provide a systematic tool for data collection of ICT usage and benefit future empirical research. This project focuses on a specific item of ICT investment in the meeting and event industry, namely Internet Room Diagramming Solutions (RDS).

Chapter 3 – Methodology and Methods

Chapter 3 – Methodology and Methods

3.1 Introduction

This chapter describes the methodology and techniques used in this research. The following topics will be covered. First, the reasons for the discussion of philosophical issues; ontology and epistemology of economic value and effectiveness. Second, the method description of the modified Delphi study and the Analytic Hierarchy Process (AHP); the reasons for adoption of the modified Delphi method and AHP. Third, the research design, the structure of this thesis and how to trust the findings.

Different concerns around innovation diffusion contribute diverse diffusion research studies and add value to each of the social science disciplines. Economists are concerned with the increase of economic growth and productivity brought by technological innovation; anthropologists try to understand the process of social change stimulated by innovation; the researchers in the field of organisation are concerned with how an organisational structure is influenced by the adoption of a new technology. The researchers who prefer to use anthropological approaches in the studies of innovation diffusion avoid using quantitative tools such as random sample surveys and personal interviews. Instead, participant observation, which gathers diffusion data directly from their respondents, is usually adopted in the attempt to collect the perspective of respondents by participating in the daily activities of the innovation diffusion of the respondents (Rogers 2003). The micro-level details of innovation diffusion could, therefore, be provided through the results of such inquiry. The pro-innovation bias, which implies an innovation is good and should be always diffused and adopted, could be overcome (Rogers and Shoemaker 1971). However, it is argued that this anthropological approach may have to wait a long time for the diffusion or adoption behaviours to appear and also it is limited within small systems (Rogers 2003), in a special case of this research such as convention centres. The results of the anthropological innovation diffusion studies, therefore, have comparatively less potential to be generalised.

3.2 Research Aim and Objectives

This research addresses the concerns about how event venues may utilise the advantages offered by today's Information and Communication Technologies (ICT), particularly Room Diagramming Solutions (RDS), to better compete for incoming global meeting and event industry and improve its profitability and continuous success. A defined research problem may be used, as the first step, to provide clarification in any research project (Blaxter et al. 2003). There is a gap in the assessment studies of the adoption of Internet RDS within both meeting and event and eTourism literature. To the authors' best knowledge, only limited previous studies include RDS within their research on eBusiness applications, and there are no published academic articles that focus on the economic value and effectiveness of Room Diagramming Solutions to venue operators (Jones and Baloglu 2006; UNLV 2001). Thus, this research intended to develop a framework to help event venue managers to monitor the economic sustainable efficiency of their Room Diagramming Solutions. The aim of this research is to incorporate a comprehensive set of dimensions and criteria to develop a flexible and practical indicator system for the evaluation of the economic value and effectiveness of RDS.

The objectives of this research are to:

- construct a methodology for the evaluation of the economic sustainable effectiveness of RDS,
- establish the relative value of implementing RDS in event venues,
- generate a comprehensive set of dimensions for the evaluation of the economic sustainable effectiveness of RDS,
- identify key stakeholders' views on the criteria used to measure RDS system effectiveness,
- weight the dimensions/criteria identified according to the views of venue managers.

This research results will also be able to help promote greater understanding of the general ICT effectiveness and productivity issues which concern meeting and event venue managers in the real world.

3.3 Quantitative Research

The process of establishing methodological position can help researchers to clarify their research design (Easterby-Smith et al. 2002). What kind of evidence a research project needs, how to gather and interpret this information and how to provide answers to the research questions with which the research is concerned are all involved in this process. Researchers are able to know if their research design will fulfil the set aims and objectives; the limitations of the research will also be indicated. The methodological position could be discussed by the use of a paradigm, which is defined as a basic set of beliefs that guides how to conduct a study and action (Guba 1990). The ontological position is concerned with questions about the nature of reality; the epistemological position raises the question of how do we know the world; the methods ask how we gain knowledge within the context of the selected nature of reality. These three elements are the main issues to be discussed when choosing a research paradigm.

According to the set aim and objectives of this research, several philosophical presumptions are implied, and the nature and limitations of this research are also disclosed. It is claimed by Hollis (1994, p. 54) that “economic theorists cannot proceed in philosophical innocence”. This research took the position of the existence of an external economic reality that governed past, present and future economic outcomes: a single social reality (Davidson 1996). As defined by the theory of objective value in economics, “the value of an object, goods or service is intrinsic or contained in the item itself” (Allen et al. 2008, p. 41). Therefore, there is an objective truth in this external reality. From the point of view of this philosophical presumption, societal economic value in for-profit organisations is an external reality that is not susceptible to change induced by human action. Following the assumptions of the theories of rationality in economics, the “rational” managers, the decision makers, in for-profit organisations intend to accomplish their responsibilities which are to consistently maximise the economic profit to the owners of the organisations (Becker 1976). In this research the aim and major concerns are to establish a framework which could be used by venue managers to evaluate the

economic value and effectiveness of a specific ICT innovation. The economic value and effectiveness are, therefore, regarded as external reality in the chosen ontological position. The managers could tend to the view that the economic goals which their organisations pursue are an external reality. The managers learn and apply the economic regulations and rules. By taking this position, it is assumed that the investigator and the investigated 'object' (the key elements which compose the evaluation framework) are to be detached, independent entities, and the investigator is capable of studying the object without influencing it or being influenced by it (Perera and Sutrisna 2010). This ontological and epistemological assumption that this research has taken in terms of the nature of reality and the relationship between the knower and the known then influences the approach chosen to inquire into the nature of the world (Easterby-Smith et al. 2002). Methodology is concerned with how we gain knowledge within the context of the selected nature of reality (Denzin and Lincoln 1994). As a result, quantitative methodology which aims to understand how to measure some items or how many people hold a particular view by conducting statistical analysis or testing theories was adopted in this research.

Tornatzky and Klein (1982) suggest that quantitative approaches such as surveys, secondary data analysis and experiments which allow some degree of cross-study comparison and replicability may be methodologically suitable for the model studies of innovation characteristics. In their meta-analysis of seventy-five articles pertaining to innovation characteristics, 54.7% implemented survey methods. It is also argued that researchers tend to infer a conclusion of the characteristics of an innovation to the adopters from the judgments of researchers themselves rather than use the perception of users (or decision-makers and experts) to detect the degree to which an innovation is suitable for the adopters, which is considered relatively objective. Use of a scale system (i.e. 1 to 5) is suggested for use in the measurement in order to aggregate stakeholder' views on an innovation (Ettlie and Vellenga 1979). For example, some previous research used the Likert Scale when conducting surveys to identify ICT evaluation indicators (Fuchs et al. 2009).

3.4 Perception-Based Methods

Tornatzky and Klein (1982) advocate that the adoption and post-adoption of various innovations could be predicted and monitored through the perception-based innovation characteristics, and they argue that in the context of a relatively homogeneous society nowadays there is some degree of consistency across various settings and organisations. Rogers (2003) claims that subjective and perceived attributes of innovation diffusion drive the innovation diffusion process and could affect the success of the innovation adoption. However, he believes that the ultimate goal of diffusion research on innovation attributes is to build a general classification system which allows the perceived attributes of innovation to be described in universal terms. Five conceptually distinct attributes of innovations are, therefore, summarised by Rogers from the past fifty years of related research: relative advantage, compatibility, complexity, trialability and observability. The five perceived attributes suggested by Rogers have been investigated heavily in the past decades (Moore and Benbasat 1991; Tornatzky and Klein 1982; Zhu and Kraemer 2005). Zhu et al. (2003) believe that innovation theories have the potential to be generalised and could be developed as a framework for studying eBusiness use and value.

Furthermore, it was found that the perceptual data from senior managers correlate with objective economic performance measures such as revenues and productivity (Tallon and Kraemer 2007; Venkatraman and Ramanujam 1987). Jarvenpaa and Ives (1991) found that senior managers' perceptions toward ICT and organisations' progressive use of ICT have a strong relationship and association. Kuan and Chau (2001) suggest that characteristics of a specific ICT innovation could be identified through a perception-based approach such as surveying decision makers and users. Some previous research such as Fuchs et al. (2009) has used subjective data for examining factors associated with ICT innovation adoption and consequences. Moreover, Zhu et al. (2006) and Fuchs et al. (2010) have started to use senior managers' perceptions of the economic impact and usage of ICT adoption and post-adoption when developing models or frameworks for the monitoring of ICT diffusion.

The selection of a research design is subject to the availability of techniques, procedures, protocols and a sampling plan (Cooper and Schindler 2006). Tallon et al. (2000 p. 148) claim that "in the absence of objective data on IT payoffs, executives' perceptions can at least help to pinpoint areas within the corporation where IT is creating value". The aim of this research is to develop a framework to help event venue managers, as the key stakeholders, to monitor the economic value and effectiveness of Room Diagramming Solutions in their venues. Tornatzky and Klein (1982) suggest that a replicable measurement approach to decision-makers' or adopters' perceptions is a better method by which to conduct the studies on innovation characteristics than inferring the extent to which a characteristic was present. "The human mind is capable of absorbing, assembling, sorting, and synthesising large amounts of evidence, information, experiences and data" (Crouch 2011, p. 30). As a result, this RDS research would like to test and validate the theories, such as the frequently cited Rogers' Innovation Diffusion Characteristics and the TOE framework which have been raised and tested in the general research of the ICT impact and ICT effectiveness in the business field, by surveying the targeted decision-makers, stakeholders and venue managers.

3.5 Candidate Key Performance Indicators

The first step in this project was to conduct desk research by a review of relevant literature. After this extensive theoretical study, some possible candidate Key Performance Indicators (KPIs) suggested by previous ICT productivity and effectiveness research could be listed in a systematic way. The results of this initial research then formed the basis for the design of an outline questionnaire.

It is suggested that the measurement items used in the framework development process could be generated through literature review (Zhu et al. 2006). Tornatzky and Klein (1982) suggest that by using the relative variables, such as costs over budget, innovation characteristics like relative advantage could be provided in a more objective manner compared to the measures which merely rely on perceptions from adopters. Fifteen scale indicators were developed by Moore et al. (1996) to

measure Rogers' five attributes of innovation diffusion for personal computers in the field of information technology. These indicators were selected from seventy-five items investigated through four rounds of expert judgments and the factor analyses of seven companies and 540 employees. Rogers (2003, p. 225) suggests that with proper adaptation, the five attributes of innovation diffusion identified by his research could be expressed differently in each study and "the measures of these attributes should be uniquely created afresh in each investigation".

Zhu and Kraemer (2005) claimed that due to the unique Internet characteristics of eBusiness, specific antecedents and impact indicators which could be used for monitoring its organisational use should be developed. They believe that apart from the technological competence of the adopting organisations, particular organisational factors and environmental factors may also affect eBusiness use. RDS products and services as the example shown in Table 10 can be viewed as an eBusiness application when equipping in venue organisations. Swanson (1994) believed that new technologies may have specific contexts which could be represented by additional variables which vary from the original innovation diffusion theory identified. Zhu et al. (2006) suggest that some new innovation characteristics of eBusiness which may be different from the previous generation of IT innovations need to be explored and deserve attention. The innovation characteristics for a specific ICT innovation could be built starting from the adoption of the classical innovation theory, but should be tailored in terms of specific industry characteristics when conducting framework development research. The characteristics used should be tailored to the specificity of the innovation (Chau and Tam 1997).

Table 10 – Value Description of a Room Diagramming Solutions Products & Services

Value Description
The MeetingMatrix suite of products and services promotes a property and its event space to the world through a variety of options; from web-based products that showcase a venue's entire property and event space directly from their own website, to print collateral and many other creative services offered by their strategic partner, VisionaryFX.
The guaranteed accurate computer diagrams built from MeeingMatrix's measurements reflect that accuracy which gives event planners confidence in plans built around them. Planners no longer have to travel to a hotel/venue for costly site inspections just to determine if the venue will work for them. Sometimes, planners require several set-up changes and MeetingMatrix makes it easy to rearrange a room set-up.
Facilitating the communication between meeting planners and the event sites they use.
Starting with SiteVisit®, web visitors get a geographic bird's eye view of a city or region. Planners get snapshots of all that a destination's area has to offer, from meeting facilities and hotels, to attractions, restaurants, transportation, etc. The implementation of iPlan™ for a single facility will allow users to view different aspects of the facility, from the actual layout of the venue with drill-down capabilities from a campus map, to stacked floorplans and even individual guest and meeting rooms.

Source: MeetingMatrix (2012)

Considering the previous research results, the characteristics of RDS as discussed in Chapter Two and the value description of RDS as shown in Table 10, a list of potential Key Performance Indicators (KPIs) for determining the productivity and

effectiveness of RDS was drafted as shown in Table 11. This potential KPIs list is mainly grounded in Innovation Diffusion Theory, the TOE framework and the eBusiness impact model. Considering the degree of detailed description, relevance and completeness of the recommended KPIs in previous research, the studies conducted by Rogers (2003) (for F3; F4; G1; H1), Zhu and Kraemer (2005) (for J2), Zhu et al. (2006) (for E1; E2; E3; F1; I1; I2; I3; K1; K2), Fuchs et al. (2009) (for F2; J1; J3) and Fuchs et al. (2010) (for A1; A2; A3; A4; B1; B2; B3; B4; C1; C2; D1; D2; D3) were adopted as the key bases for the development of the KPIs descriptions which can been seen as Table 11.

Table 11 – Comparisons between Original KPIs and Adapted KPIs for RDS

Original KPIs Used in Previous Literature	Adapted KPIs for RDS
Number of guests from new sending countries	A1_Number of new guests through ICT application
Booking rate at the destination	A2_Booking rate at the meeting/event venue
Regional market share	A3_Regional market share
Labour productivity	A4_Sales per labour hour
Costs of internal processes	B1_Costs of internal processes
Labour productivity	B2_Costs per labour hour
Costs of coordinating business partners	B3_Costs of coordinating business partners
Marketing costs	B4_Marketing costs
Quality of relationship to tourism service providers	C1_Quality of relationship with meeting/event service suppliers (e.g. Catering service suppliers)
Quality of relationship to tourism organisations	C2_Quality of relationship with meeting/event planners (e.g. Wedding planners)
Satisfaction of tourists	D1_Satisfaction of meeting/event guests
Quality of relationship to tourists	D2_Quality of relationship with meeting/event guests
Satisfaction of tourism service providers	D3_Satisfaction of meeting/event planners
Selling over the Internet is compatible with your company's current selling process	E1_RDS products and services are compatible with the meeting/event venues' current selling processes
Conducting transactions over the Internet is compatible with existing distribution channels	E2_RDS products and services are compatible with the existing distribution channels
Doing eBusiness is compatible with your company's corporate culture and value system	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate culture and value systems
Costs of implementing Internet-based online sales (including hardware, software, training, organisational restructuring, business process reengineering)	F1_Cost of integrating RDS products and services to the venues' sales (including hardware, software, training, organisational restructuring, business process reengineering)
ICT training costs	F2_Training hours to the operators in the meeting/event venues for the application of RDS products and services
The degree to which an innovation is difficult to use	F3_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event venue staff
The degree to which an innovation is difficult to use	F4_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event planners

The degree to which the results of an innovation are visible to others	G1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to search for (e.g. In the websites of the venues)
The degree to which an innovation may be experimented with	H1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to experiment with (e.g. In the websites of the venues)
IT infrastructure: the strength of existing IT infrastructure, as measured by related technologies that your company has in place, including electronic data interchange (EDI), intranet, extranet, local area network (LAN), wide area network (WAN)	I1_ICT Infrastructure: the strength of existing ICT infrastructure, as measured by related technologies that the meeting/event venue has in place, including electronic data interchange (EDI), intranet, extranet, local area network (LAN), wide area network
Internet skills: The extent to which the majority of your employees are capable of using the following applications - Web browser, intranet, online order processing	I2_ICT Skills: the extent to which the majority of the employees in the meeting/event venue are capable of using the following applications - web browser, intranet, online Request for Proposal (RFP) processing
Skill development – Has your company done the following to help employees develop e-business skills: (a) in-house training? (b) participating in IT training such as courses and seminars by third parties? (c) legitimizing certain work time for IT learning/training? (d) establishing self-learning or e-learning programs? (e) recruiting staff with special IT skills?	I3_Skill Development: the extent to which the meeting/event venue has implemented the following in order to help employees develop eBusiness skills such as (a) in-house training; (b) participation in ICT training such as courses and seminars run by third parties; (c) designating certain work time for ICT learning/training; (d) establishing self-learning or e-learning programs; (e) recruiting staff with special ICT skills
Firm size: number of employees	J1_Organisation Size: number of employees in the meeting/event venue
IS operating budget, as percentage of total revenue	J2_Financial Commitment: ICT operating budget, as percentage of total revenue
hotel star- 0/1/2/3/4/5	J3_Organisational Type: hotel star- 0/1/2/3/4/5
Percentage of competitors in your industry that have conducted Internet-based services	K1_Perceived Competitive Pressure: percentage of competitors in the city of the meeting/event venue that have adopted ICT room diagramming solutions
The extent to which downstream customers have eBusiness systems ready to support Internet-based selling	K2_Perceived Stakeholder Pressure: the extent to which downstream customers (meeting/event planners) have eBusiness systems ready to support ICT room diagramming solutions

3.6 The Indicator System for Monitoring the Economic Value and Effectiveness of RDS

A repeatable and multiple measures approach could fulfil the needs of longitudinal studies on implementation of innovations (Tornatzky and Klein 1982). The framework development research could be viewed as the first step of a longitudinal study of the productivity and effectiveness of RDS which may provide dynamic views of the specific ICT innovation usage and impact in venue management.

A range of performance indicators, which reflect variation in service quality and illustrate the gaps between expected and actual performance, could be used to monitor the quality of the use of ICT technologies (Parmenter 2010; Sirirak et al. 2011). Performance indicators, which could be qualitative or quantitative, ensure that variable performances lie within acceptable limits and help managers to maintain a high level of satisfaction among the clients who receive the services (Scholtes 1998). The performance-related indicators may also help managers, such as meeting and event venue operators, to plan adaptive and innovative strategies (Espejo et al. 1999).

"An innovation is communicated through certain channels over time among the members of a social system" (Rogers 2003, p. 11). Rogers suggests that the innovation itself, communication channels, time and the social system are the four major elements identified by previous innovation diffusion research studies, campaigns or programs. It is a complex task to monitor the effectiveness of ICT and management for employees, operational managers and high-level managers within an organisation or a system (Batchelor and Norrish 2003). Moreover, replicable measures of innovation characteristics are more meaningful and generalizable than these inferred ones (Tornatzky and Klein 1982). Measuring the characteristics of an innovation diffusion at one point in time may not be able to provide a clear picture of the relationship of such characteristics and the success of the innovation adoption (Rogers 2003). Zhu and Kraemer (2005) admitted that their research which merely tested the characteristics at one point cannot empirically examine whether the economic value and effectiveness created by ICT innovation is sustained and, therefore, they suggested further longitudinal studies. The Organisation for

Economic Co-operation and Development (OECD) "pyramid of indicator sets" (Figure 5) which considers varied needs for different users is proposed for use in this research in the light of its multifaceted characteristics. Through systematic synopsis, condensation and integration processes, a framework showing a hierarchy of information indicators could provide different users with a varied total quantity of information in a reasonable way (Chang and Yu 2001). Moreover, the structured hierarchical indicator system will allow further longitudinal analysis to be conducted. Crouch (2011) uses the concept of a hierarchy of information indicators to develop a model for monitoring the destination competitiveness and sustainability in the tourism management domain. Furthermore, by using the technique of Analytic Hierarchy Process (AHP) in Crouch's research thirty-six attributes of competitiveness were evaluated and given weightings.

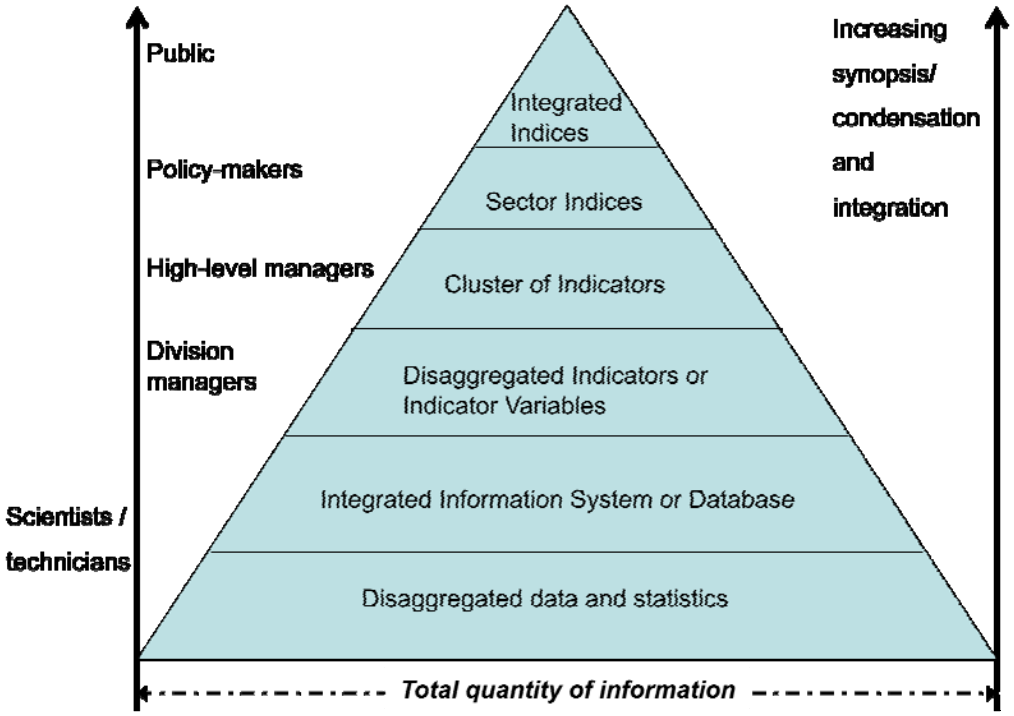


Figure 5 – Relationship between Data, Indicators, Information and Users: the OECD "Pyramid of Indicator Sets"

Source: Chang (2001), Kuik and Verbruggen (1991) and Pintér, Zahedi and Cressman (2000) adapted by this research

This ICT productivity and effectiveness research for Room Diagramming Solutions is supported by the DOI theory and the TOE framework. This investigation will then lead to the research's next step of constructing a specific indicator system for the monitoring of efficiency gains arising from the use of Internet Room Diagramming Solutions through the adaptation of the concept of the OECD "pyramid of indicator sets". The theoretical framework figure for this research can be seen in Figure 6.

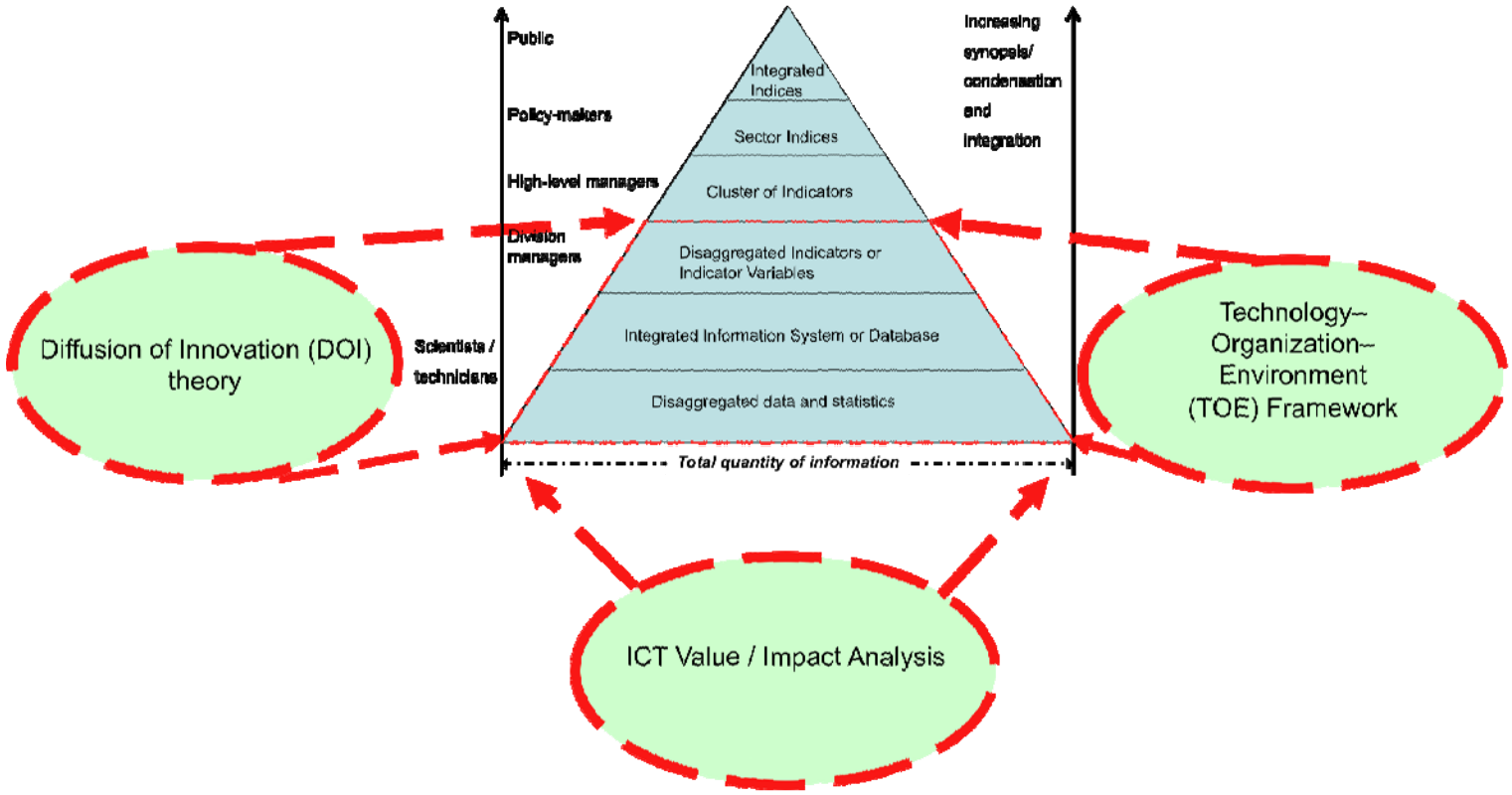


Figure 6 – The Framework of the Theories used in this Research

3.7 Development of the Evaluation Hierarchy

Different from the focuses of previous relevant research, this study does not put emphasis on the internal relationships among the factors in varied dimensions. A hierarchical view has been used in order to concentrate the research focuses on exploration of the relative association degrees of these factors to the goal, the productivity and effectiveness of RDS. A straightforward four-level hierarchical structure was constructed according to previous research on eBusiness/ICT evaluation, Innovation Diffusion Theory, the TOE framework and the eBusiness impact model. The highest level of the hierarchy is the overall goal: to develop an evaluation framework for determining the productivity and effectiveness of RDS. Under the overall goal, the second level represents the categories accounting for the economic value and effectiveness of RDS. Various factor tiers associated with each category in the second level are linked to the third level. The proposed candidate Key Performance Indicators (KPIs) in the fourth level form each factor tier. Table 12 demonstrates the hierarchical structure.

Table 12 – A Hierarchical Structure of the Proposed Candidate Key Performance Indicators

Category	**Factor Tier**	**Key Performance Indicator**
Category One: Room Diagramming Solutions Value	**Factor Tier A_ Impact on Sales**	A1_Number of new guests through ICT application
		A2_Booking rate at the meeting/event venue
		A3_Regional market share
		A4_Sales per labour hour
	Factor Tier B_ Impact on Efficiency	B1_Costs of internal processes
		B2_Costs per labour hour
		B3_Costs of coordinating business partners
		B4_Marketing costs
	Factor Tier C_ Impact on Business Partner Relationships	C1_Quality of relationship with meeting/event service suppliers (e.g. Catering service suppliers)
		C2_Quality of relationship with meeting/event planners (e.g. Wedding planners)
	Factor Tier D_ Impact on Customer Satisfaction	D1_Satisfaction of meeting/event guests
		D2_Quality of relationship with meeting/event guests
		D3_Satisfaction of meeting/event planners
Category Two: Room Diagramming Solution	**Factor Tier E_ Compatibility: the degree to which an innovation is**	E1_RDS products and services are compatible with the meeting/event venues' current selling processes
		E2_RDS products and services are compatible with the existing distribution channels

Category	Factor Tier	Key Performance Indicator
Innovation Diffusion Characteristics	**consistent with existing business processes, practice and value systems**	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate culture and value systems
	Factor Tier F_ Complexity: the degree to which an innovation is difficult to use	F1_Cost of integrating RDS products and services to the venues' sales (including hardware, software, training, organisational restructuring, business process reengineering)
		F2_Training hours to the operators in the meeting/event venues for the application of RDS products and services
		F3_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event venue staff
		F4_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event planners
	Factor Tier G_ Observability: the degree to which the results of an innovation are visible to others	G1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to search for (e.g. In the websites of the venues)
	Factor Tier H_ Trialability: the degree to which an innovation may be experimented with	H1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to experiment with (e.g. In the websites of the venues)
Category Three: Information and Communication Technologies Usage	**Factor Tier I_ Technology Competence: the existing technologies in use and relevant technical skills available in the organisation**	I1_ICT Infrastructure: the strength of existing ICT infrastructure, as measured by related technologies that the meeting/event venue has in place, including electronic data interchange (EDI), intranet, extranet, local area network (LAN), wide area network (WAN)
		I2_ICT Skills: the extent to which the majority of the employees in the meeting/event venue are capable of using the following applications - web browser, intranet, online Request for Proposal (RFP) processing
		I3_Skill Development: the extent to which the meeting/event venue has implemented the following in order to help employees develop e-business skills: (a) in-house training; (b) participation in ICT training such as courses and seminars run by third parties; (c) designating certain work time for ICT learning/training; (d) establishing self-learning or e-learning programs; (e) recruiting staff with special ICT skills
	Factor Tier J_ Organisational Context: internal measures of the organisation	J1_Organisation Size: number of employees in the meeting/event venue
		J2_Financial Commitment: ICT operating budget, as percentage of total revenue
		J3_Organisational Type: hotel star- 0/1/2/3/4/5
	Factor Tier K_ External Environmental Context: the external arena in which a company conducts its business	K1_Perceived Competitive Pressure: percentage of competitors in the city of the meeting/event venue that have adopted ICT room diagramming solutions
		K2_Perceived Stakeholder Pressure: the extent to which downstream customers (meeting/event planners) have eBusiness systems ready to support ICT room diagramming solutions

3.8 Modified Delphi Method

In this research the aim and major concerns are to establish a framework which could be used by venue managers to evaluate the economic value and effectiveness of a specific ICT innovation. The economic value and effectiveness are regarded as a single external reality in the chosen ontological position as discussed in detail in 3.3. Therefore, the framework and the components of this model for the evaluation of the economic value and effectiveness are also assumed as a single external reality. Furthermore, it was found that the perceptual data from senior managers correlate with objective economic performance measures such as revenues and productivity as discussed in detail in 3.4. As a result, the Delphi Method which seeks and requires an expert panel to reach consensus or agreement on a single reality is considered useful in this research.

Delphi, the site of the most important oracle in Greek mythology and the place where Greeks worshipped the god Apollo, is an archaeological location in Greece on the south-western face of Mount Parnassus (Linstone 1978). The Delphi technique, which adopted the synonymous meaning of receiving good judgment on an issue from this root, was developed in 1944 by two mathematicians, Norman Dalkey and Olaf Helmer. At the beginning of the cold war it was used to forecast the impact of technology on warfare (Custer et al. 1999; Fisher 1978). Kaplan et al. (1949) stated that under the fundamental premise that individual statistical predictions were stronger than unstructured, face to face group predictions, the Delphi method was developed as an iterative process that compiles opinions from individuals. The "method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem" (Linstone and Turoff 1975, p. 3). It is claimed that the Delphi method decreases many of the obstacles associated with personal interactions (Keeney et al. 2011). Since the development of the Delphi method, a broadening range of uses of this method, mostly concerned to identify priorities and gain consensus from a group of individuals, is now commonly used in diverse disciplines and research areas such as health, nursing and business management studies (Akins et al. 2005; De Meyrick 2003; Kastein et al. 1993).

Based on the original purpose of facilitating group communication, Delphi was described as a method used to obtain the most reliable consensus of opinion from a group of individuals through conducting several rounds of intensive questionnaires interspersed with controlled feedback (Dalkey and Helmer 1963). It is claimed that anonymity could be used to reduce the negative issues associated with group interaction in the Delphi process (Keeney et al. 2011). Cone (1978) claims that the Delphi process, which does not require the members of an expert panel to defend their positions, does, however, allows each member to be involved in each step of the process. In addition, the process facilitates the natural development of a consensus. McKenna (1994) defined the Delphi method as a multi-staged survey which attempts ultimately to achieve consensus on an important issue, idea, argument or opinion. The iterative questionnaires allow participants to interact with other panel members over a relatively long period of time while they respond to each round. In essence, all definitions basically agree that the intention of the original method is to achieve agreement, where none previously existed on a certain issue, among a group of individuals (Keeney et al. 2011). With increasing usage, broader definitions have been put forward. For instance, it is believed that the Delphi method, also defined as a process of systematic collection and aggregation of informed judgments from a group of knowledgeable individuals, so-called ‘experts’, on specific issues, could also be used to clarify the distribution of group opinions and improve the understanding of a range of research questions (Reid 1988; Singh and Kasavana 2005).

There are many differing forms of the Delphi method in existence, such as the ‘modified Delphi method’ (McKenna 1994; Rauch 1979), the ‘policy Delphi method’ (Crisp et al. 1997), and the ‘real-time Delphi method’ (Beretta 1996). These forms have been developed from the original process of the Delphi method, today known as Classical Delphi, which consists of two or more rounds of questionnaires administrated by post to an expert panel (Crisp et al. 1997). In the conventional original form, an open-ended style is adopted in the first-round questionnaire requesting the expert panel for their opinions on a certain issue. The researchers or

facilitators then analyse these responses and return them to the expert panel in the form of statements. In the second-round questionnaire, the expert panel is asked to rate or rank the statements according to their 'expert' opinion on the subject. Rounds continue until a consensus level pre-set by facilitators is reached on some or all of the items as required (Keeney et al. 2011).

Murray and Hammons (1995) argued that as the process of Classical Delphi does not require participants to meet face to face, it is difficult to ensure that the participants fully comprehend the purpose of the study. Therefore, developing the first round of Classical Delphi questions needs careful consideration (Franklin and Hart 2007). In response to this difficulty, an approach has been developed where the expert panel is provided with pre-selected issues of high pertinence by the researchers or facilitators in the first round of a Delphi on which panel members should make individual judgment (Keeney et al. 2006). These issues could be selected through a review of the relevant literature, focus groups or other forms of consultation with key stakeholders (Eggers and Jones 1998). This approach is often referred to as a Modified Delphi as it dispenses with the traditional open-ended format in the first round. Keeney (2009) claims that a Modified Delphi orientates panellists and ensures that every individual in the group starts from a common base and this lends itself to easier statistical analysis and interpretation. A narrowed scope of the research issue could increase the probability of high quality of responses from the expert panel (Story et al. 2001). By adopting this approach, it has been reported that Modified Delphi usually may use fewer rounds to reach a pre-set consensus and at the same time resolve the difficulty of retaining a high response rate within a Delphi study that has many rounds (Beech 1997; Green et al. 1999; McKenna 1994; Proctor and Hunt 1994). Considering the advantages supplied as mentioned above, the Modified Delphi method was chosen as the major instrument by which to conduct this research which concerns and focuses on stakeholders' perceptions and consensus on the economic value and effectiveness of RDS.

Keeney et al. (2011) argue that a classic and modified Delphi could accommodate either qualitative or quantitative approach or both. A Delphi study could be designed

and implemented as a positivist paradigm in the selected epistemological assumptions due to the application of single statistical measures to the identification of consensus and the assumption of objectivity of researchers (Day and Bobeva 2004). The Delphi study may seek and require the expert panel to reach consensus or agreement on a single reality, which lend the research to a positivist paradigm in the selected ontological assumptions (Monti and Tingen 1999). “The reductionist approach to the identification of the phenomenon under study” could be implied in the research enquiries into the nature of the Delphi study (Hanafin 2004, p. 7). It is claimed that the philosophic assumptions underlying the usage of a Delphi study may lead to the research design and implementation of the study (Vazquez-Ramos et al. 2009). Considering, first, the aim of the present research: to develop a framework to help event venue managers to monitor the productivity and effectiveness of Room Diagramming Solutions in their venues and, second, the discussion of the selection of the philosophical assumptions in 3.3; therefore, the present Delphi study is underpinned with the features closely associated with a positivist paradigm.

3.8.1 Modified Delphi Method – Panel Selection Process

Considering the above previous research results and the characteristics of RDS, a hierarchical structure and a list of potential Key Performance Indicators (KPIs) for determining the productivity and effectiveness of RDS was drafted as shown in Table 12. An expert panel of Modified Delphi Method was recruited to validate and to provide feedback to this list of KPIs which is mainly grounded in Innovation Diffusion Theory, the TOE framework and the eBusiness impact model through the use of modified Delphi technique.

Tornatzky and Klein (1982) suggest that innovation characteristics should be rated by different members and several echelons within organisations in order to reach aggregated results. Tornatzky and Luria (1992, p. 141) consider that in order to develop a comprehensive, coherent and focus framework for the processes of technological innovation, a diverse set of participants within the specific industry should be involved the establishment processes and join the “big table” discussion. Furthermore, it is claimed that the meaning of an innovation could be better

measured through the perceptions of the adopters rather than of the agents who introduce the innovation (Rogers 2003). To the author' best knowledge, only limited previous studies include RDS within their research on eBusiness applications, and there are no published academic articles that focus on the economic value and effectiveness of Room Diagramming Solutions to venue operators (Jones and Baloglu 2006; UNLV 2001). Therefore, in order to ensure that the members of the expert panel have sufficient knowledge and experience of RDS, three criteria were used to select potential panellists in this research: the key persons who are in charge of the investment decision of RDS in meeting and event venues (i.e. hotels or convention centres); the educators in higher education institutes who include RDS in their teaching courses; the industrial consultants recognised by the RDS industry.

The research received assistance from a leading RDS service supplier, MeetingMatrix (www.meetingmatrix.com), who provided a list of contacts from its database based on the above three criteria. A support team which included the Vice President of Operations, the Director of Customer Relations, the Director of Marketing and the Director of Sales in MeetingMatrix was assembled to facilitate the assistance to the research. MeetingMatrix RDS has been recognised as one of the latest and most accurate tools in the event industry for planning by the Professional Convention Management Association (PCMA) (TravelDailyNews 2007). Since 2005 the PCMA Space Verification has used MeetingMatrix RDS as its industry standard (Davis 2005). It was claimed that MeetingMatrix, which was founded in 1988, held approximately 80 per cent of the captured market share in both software and diagramming solutions for the global meeting industry (Business Wire 2005) (see detailed in 2.4 Room Diagramming Solutions).

A list of 69 contacts was provided by the MeetingMatrix support team under the set first criteria which were used to select potential panellists in this research (the key persons who are in charge of the investment decision of RDS in meeting and event venues). The 69 contacts were collected and identified from a previous mass venue client survey carried out by MeetingMatrix, and all of the contacts had agreed to participate in any future MeetingMatrix survey or research. A list of 10 educators

was provided by MeetingMatrix under the set second criteria (the educators in higher education institutes who include RDS in their teaching courses). The 10 educators all had requested MeetingMatrix software to be installed in their education institutes for the use of their students. A list of 11 industrial consultants was provided by MeetingMatrix under the set third criteria (the industrial consultants recognised by RDS industry). The 11 industrial consultants, who had been identified and recognised by MeetingMatrix's sales team, had agreed from 2010 to serve on the Advisory Board of the MeetingMatrix Meeting and Event Technology Laboratory (The MET LAB) at Queen Margaret University. They were selected from a list which was suggested by both MeetingMatrix (the sponsor of this project) and Professor Joe Goldblatt (the member of the supervisory team of this project) and invited to be advisory board members. They have worked closely with the MeetingMatrix Meeting and Event Technology Lab for a year on the development project of MeetingMatrix Meeting and Event Technology Curriculum and therefore have good knowledge and expertise in Room Diagramming Solutions (RDS) with which this project is concerned. The consent form and information sheet for this research were sent to the 90 recognised experts, and 33 of the contacts returned the consent form.

3.8.2 Modified Delphi Method – The First Round

In the first round of this modified Delphi research, the candidate KPIs list was distributed to the panellists through an electronic survey. The Bristol Online Survey system (http://www.survey.bris.ac.uk/) was used to construct the survey (Appendix 4). A five-point Likert scale (1: Strongly Disagree; 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly Agree) was adopted to detect how strongly the experts agree or disagree with the KPIs that should be included in an evaluation framework to monitor the effectiveness of the RDS in value creation processes at meeting/event venues. A glossary based on previous literature (Amit and Zott 2001; Horan 2010; The World Bank 2011) was included in an attempt to avoid ambiguities (Appendix 2). Online PowerPoint presentations (Appendix 3) regarding the aim, objectives and background of this research were embedded in the online surveys and a personal

organiser was offered in order to ensure that every participant could understand and relate to the tasks regardless of their discipline or background (Saizarbitoria 2006).

Each member of the Delphi expert panel then answered the questionnaire individually. After the first round, an anonymous summary of the experts' forecasts from the previous round was provided in the next round. In this way, experts could refer to their earlier answers and consider revision in the light of the replies of other members of this expert panel (Keeney et al. 2011). It was hoped that a degree of consensus could be reached through this process. In addition, the experts were also asked in the first round to provide their comments or if there were any amendments or additions that they would like to make to the framework and the KPIs. Furthermore, it is suggested that self-assessment of experts' level in the knowledge fields is an often used approach to understand and to justify the quality of a Delphi study (Keeney et al. 2011). Two questions with a knowledge level table were designed in this first round survey to investigate participants' knowledge level of ICT and RDS effectiveness based on their awareness, reading or working (Appendix 4).

3.8.3 Modified Delphi Method – The Second Round

In order to confirm a correct set of the identified proposed indicators in the first round modified Delphi study, it was necessary to revalidate the proposed indicators which had been carefully revised based on the suggestions from the previous round of the Delphi panel.

It is argued that in a Delphi study which has many rounds of survey it may be difficult to retain a high response rate: for example, in a Delphi study conducted by Day and Bobeva (2005) a 40% dropout rate was experienced after the first round. The panel members may need to be rewarded in a way which encourages continuing responses (Keeney et al. 2011). However, it is suggested that ethical considerations should be taken into account when encouraging responses and the participants should not feel 'forced' to continue (Beretta 1996). An appropriate feedback report which highlighted the ongoing importance of each individual panel member's contribution

to this project as suggested by previous literature (Sandrey and Bulger 2008) was provided in the follow-up reminder messages in an attempt to keep the members of the expert panel interested and involved.

In the second round survey (Appendix 6), an anonymous summary table of the first round findings, including the average score of importance, the standard deviation and cumulative percentage for each indicator, was presented to the panel members. Cumulative percentage reveals that a degree of consensus on the KPI has been reached (i.e. 70% indicates that 70% of the members of the Delphi panel voted either 'Agree' or 'Strongly Agree'). In addition, the individual result for each indicator from the previous round was also embedded along with the research questions of the second round electronic questionnaire for the Delphi panellists' reference when revalidating these revised indicators. The Delphi panellists had also been informed of the previous round results with instructions that they may consider taking these findings into account in their revalidated responses or they may ignore them (Keeney et al. 2011). The glossary which was an attempt to avoid ambiguities was extended, and the requests for clarifications to some technical terms and the suggestions from the first round expert panel were taken and included in the second round survey instrument (Appendix 6).

The Delphi approach used in this research attempts to achieve consensus on an important issue through a multi-staged survey to a panel of experts (McKenna 1994). A pre-determined consensus level, therefore, needs to be set in this attempt (Keeney et al. 2011). It is suggested that consensus could be defined as being achieved in a variety of ways, for example: a level of standard deviation (Greatorex and Dexter 2000), median (Brooks 1979) or aggregation of the judgements of respondents (McKenna et al. 2002). Considering the purpose of this research which is to identify the views of the majority of key stakeholders, the attainment of a certain level of agreement (or majority rule) was adopted as a measurement of consensus in this Delphi study: consensus on each item was equated with at least 51% (on the measurement of Cumulative Percentage in this research) which was suggested as a cut-off point by previous literature (Loughlin and Moore 1979; Powell 2003).

Therefore, items rated below this level by panel members in the second round would be discarded in the next round (Keeney et al. 2011).

3.9 Analytic Hierarchy Process

In traditional measurement used in the Delphi method such as the Likert Scale, where elements or factors are scaled one by one, the potential connections among these factors are ignored. Moreover, an evaluation model for ICT applications should not only indicate what is important to be measured but also each measurement should be weighted (Horan 2010). The Analytic Hierarchy Process (AHP) is a technique that not only generates weightings of the components within a framework but also supplies a method to synthesise the multi-attributes within a hierarchical structure, which is useful for the fulfilment of the objectives in the next step of this research.

AHP is a mathematical method which assists group decision-making. As a result of the homogeneity of judgments and the aggregation of choices via the calculation of a geometric mean, the individual views of the group members could be aggregated into a single view (von Solms 2009). In the late 1960s, the inventor and developer of the AHP, Thomas L. Saaty was disappointed in the result of the project that he led for the Arms Control and Disarmament Agency at the U.S. Department of State. This was despite the fact that his team had even included three future Nobel Prize winners in Economics who developed the game utility theories (Saaty 1996). Since then, Saaty has been motivated to develop a practical systematic approach to help decision makers to deal with complex decisions and priority setting. AHP was the result of these efforts, and recently, because of the power and simplicity of AHP and the advanced computing technologies offered, there are many commercial implementations such as the Expert Choice software (http://expertchoice.com/) and the Gartner Group's services (http://www.gartner.com/it-glossary/ahp-analytical-hierarchy-process/) which are used in many leading information technology companies such as Microsoft and IBM to assist the daily decision-making processes and in the evaluation of ICT products and services (Deb 2010; McCaffrey 2005).

Firstly, in the name AHP, analytic means the separation of a material into its constituent elements. Simon (1972) argued that hierarchical ordering exists in human thought, consciously and unconsciously leading to a popular hierarchical structure applied in large organisations. Applying this to a decision-making process, a goal is first set and then is supported by many factors. Thus, one of the major functionalities of AHP is to supply a method to synthesise the multi-attributes within a hierarchical structure. The hierarchical structuring of complexity into homogeneous clusters of factors forms the backbone of the AHP theory (Forman and Gass 2001).

Secondly, Saaty (2005) claims that the intuitive conducting of pairwise comparisons among factors is part of our biological heritage, and people may need to develop systematic approaches to cope with a world where everything is potentially relative and constantly changing: a so-called “problematique” (Chen and Yu 2008, p. 229; Zopounidis and Doumpos 2000, p. 15). In traditional measurement such as the Likert Scale, where elements or factors are scaled one by one and individually, the potential connections among these factors are ignored. AHP mainly supplies a method, based on human biology and psychology, to improve and advance the conventional approaches through a paired comparison concept. The relative values of each factor could be derived from the judgments which use numerical values taken from the AHP absolute fundamental scale. The priorities (weightings) among the factors in a homogeneous cluster with respect to their hierarchical parent are generated by this approach which uses matrix algebra and eigenvalue technique to weigh factors (Kahraman et al. 2007). Thus, the issues of measuring performance, setting priorities, structuring and synthesis in multi-criteria models could be dealt with through the application of AHP or even an extended more complex theoretical framework, the Analytical Network Process (Saaty 2005).

Thirdly, Saaty (1980) states that taking into consideration a few contemporary behaviourisms including Weber-Fechner’s Psychophysical Law of Stimuli and the Stimulus-Response theory (Masin et al. 2009), the absolute fundamental scale of one to nine is used in AHP theory to help people to make decisions according to their own understanding. He argues that by approaching the decisions in this way, people

then could feel that the decisions they made fulfil the individual or group values, goals and convictions. AHP has been described and recognised in many top management science journals, such as Operations Research, as a phenomenon which could be applied in a wide range of decision-making issues and subjects (Forman and Gass 2001). The theoretical underpinnings and mathematical psychology of AHP have, because of its popularity, also been carefully and widely investigated and examined in academic circles (Crouch 2011; Saaty and Vargas 2012). Most operations management and decision making textbooks include this method as a standard practice for multi-attribute decision analyses (Hill 2012).

Santhanam and Guimaraes (1995) used the AHP technique to develop a quality assessment framework for institutional Decision Support Systems (DSS) after the system investments had been made. They claimed that the framework may help to justify the investments in DSS and could provide a method to involve and to consider all users who may have different perspectives, objectives and expectations from the systems. Kahraman et al. (2007) used the AHP technique to prioritise the main goals and relevant subfactors of ICT management for eGovernment strategies. In the event management domain the AHP method has been used to construct evaluation models and has criterion weightings such as convention site selection model (Chen 2006) and festival site selection (Tsai and Ho 2009). In the hospitality information technology management research field the AHP method has also been adopted for calculation of user assessments of dimension/attribute weightings and performance ratings in hotel website performance evaluation (Ip et al. 2012). Furthermore, by using the technique of Analytic Hierarchy Process (AHP) in Crouch's research (2011), thirty-six attributes for the monitoring of the destination competitiveness and sustainability in the tourism management domain were evaluated and given weightings. Considering the advantages supplied as mentioned above and the successful uses in previous relevant research papers, the AHP technique was chosen as the instrument by which to implement this research which intends to generate weightings within a framework for the construction of a potential index system of RDS in the final Modified Delphi Round.

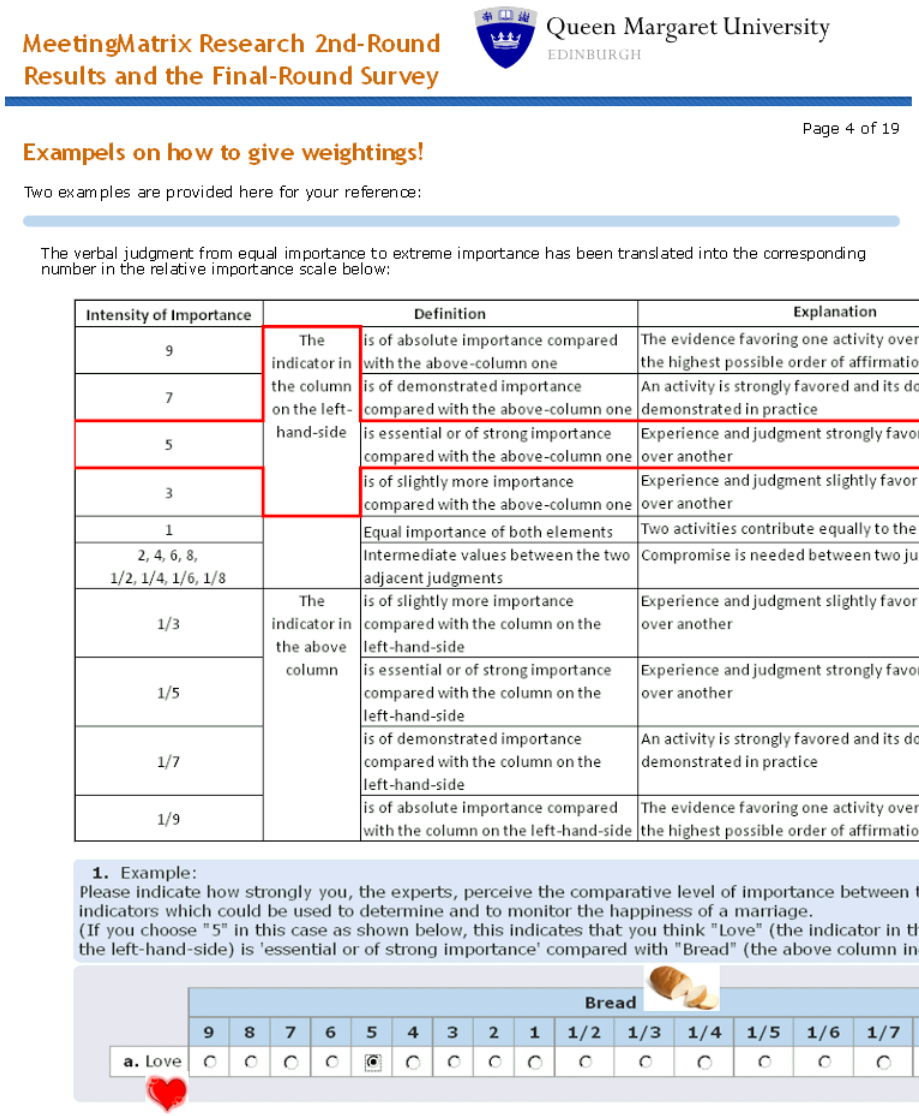
3.10 Modified Delphi Method – The Third Round

The aim of the final-round modified Delphi survey is to attempt to prioritise and to give weightings to the list of criteria, factor tiers and categories tested, generated and selected from the previous two rounds. The Analytic Hierarchy Process (AHP) technique mainly supplies a method, based on human biology and psychology, to improve and advance the conventional approaches through a paired comparison concept. The relative values of each factor could be derived from the judgments which use numerical values taken from the AHP absolute fundamental scale. The priorities (weightings) among the factors in a homogeneous cluster with respect to their hierarchical parent are generated by this approach. Thus, the issues of measuring performance, setting priorities, structuring and synthesis in multi-criteria models could be dealt with through the application of AHP.

The results of the second round Delphi survey were, therefore, arranged in the format of AHP pairwise comparisons. A questionnaire was designed in the form of a pairwise comparison based on the hierarchical structure as shown in Appendix 8. According to the feedback from the expert panel and the pre-set consensus level requirement (51% on the measurement of Cumulative Percentage), the candidate KPIs have been reduced. The AHP questionnaire (Appendix 8) was designed and distributed to the expert panel by the use of the Bristol Online Survey system. An anonymous summary table of the second round findings, including the average score of importance, the standard deviation and cumulative percentage for each indicator, was presented to the panel members. In addition, the individual result for each indicator from the previous round was also embedded along with the research questions of the second round electronic questionnaire for the Delphi panellists' reference when giving weightings to these revalidated indicators.

By the use of AHP absolute fundamental scale, the perspectives and the numerical scales of measurement of individual experts to each comparison of criteria, factor tiers and categories then were derived as shown in the example in Figure 7 Examples of AHP Comparisons from Appendix 8. These numerical scales were then filled into the software of Expert Choice (http://expertchoice.com/) to generate the weightings

for each category, factor tier and KPI given by the expert panel. Appendix 9 provides detail of the mathematical formulation and methods of AHP technique used in Expert Choice software. The software which was recommended by previous literature was used in over 1,000 AHP related academic articles and almost 100 doctoral dissertations (Forman and Gass 2001).



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Exampels on how to give weightings!

Two examples are provided here for your reference:

The verbal judgment from equal importance to extreme importance has been translated into the corresponding number in the relative importance scale below:

Intensity of Importance	Definition		Explanation
9	The indicator in the column on the left-hand-side	is of absolute importance compared with the above-column one	The evidence favoring one activity over another is of the highest possible order of affirmation
7		is of demonstrated importance compared with the above-column one	An activity is strongly favored and its dominance is demonstrated in practice
5		is essential or of strong importance compared with the above-column one	Experience and judgment strongly favor one activity over another
3		is of slightly more importance compared with the above-column one	Experience and judgment slightly favor one activity over another
1		Equal importance of both elements	Two activities contribute equally to the objective
2, 4, 6, 8, 1/2, 1/4, 1/6, 1/8		Intermediate values between the two adjacent judgments	Compromise is needed between two judgments
1/3	The indicator in the above column	is of slightly more importance compared with the column on the left-hand-side	Experience and judgment slightly favor one activity over another
1/5		is essential or of strong importance compared with the column on the left-hand-side	Experience and judgment strongly favor one activity over another
1/7		is of demonstrated importance compared with the column on the left-hand-side	An activity is strongly favored and its dominance is demonstrated in practice
1/9		is of absolute importance compared with the column on the left-hand-side	The evidence favoring one activity over another is of the highest possible order of affirmation

1. Example:
Please indicate how strongly you, the experts, perceive the comparative level of importance between the two indicators which could be used to determine and to monitor the happiness of a marriage.
(If you choose "5" in this case as shown below, this indicates that you think "Love" (the indicator in the column on the left-hand-side) is 'essential or of strong importance' compared with "Bread" (the above column indicator)).

	Bread																
	9	8	7	6	5	4	3	2	1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9
a. Love	○	○	○	○	◉	○	○	○	○	○	○	○	○	○	○	○	○

Intensity of Importance	Definition		Explanation
9	The indicator in the column on the left-hand-side	is of absolute importance compared with the above-column one	The evidence favoring one activity over another is of the highest possible order of affirmation
7		is of demonstrated importance compared with the above-column one	An activity is strongly favored and its dominance is demonstrated in practice
5		is essential or of strong importance compared with the above-column one	Experience and judgment strongly favor one activity over another
3		is of slightly more importance compared with the above-column one	Experience and judgment slightly favor one activity over another
1		Equal importance of both elements	Two activities contribute equally to the objective
2, 4, 6, 8, 1/2, 1/4, 1/6, 1/8		Intermediate values between the two adjacent judgments	Compromise is needed between two judgments
1/3	The indicator in the above column	is of slightly more importance compared with the column on the left-hand-side	Experience and judgment slightly favor one activity over another
1/5		is essential or of strong importance compared with the column on the left-hand-side	Experience and judgment strongly favor one activity over another
1/7		is of demonstrated importance compared with the column on the left-hand-side	An activity is strongly favored and its dominance is demonstrated in practice
1/9		is of absolute importance compared with the column on the left-hand-side	The evidence favoring one activity over another is of the highest possible order of affirmation

2. Example:
Please indicate how strongly you, the experts, perceive the comparative level of importance between the two indicators which could be used to determine and to monitor the effectiveness of the Internet Room Diagramming Solutions (RDS) in value creation processes at meeting/event venues.

(If you choose "1/7" in this case as shown below, this indicates that you think "A1_Increased number of new clients"(the above-column indicator) is 'of demonstrated importance' compared with "A2_Booking rate at the meeting/event venue"(the indicator in the column on the left-hand-side)).

	A1_Increased number of new clients																
	9	8	7	6	5	4	3	2	1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9
a. A2_Booking rate at the meeting/event venue	○	○	○	○	○	○	○	○	○	○	○	○	○	○	◉	○	○

You can also find a web link to these two examples within the embedded buttons of 'More Info' on each question for your review when answering the following questions.

Continue >

Figure 7 – Examples of AHP Comparisons from Appendix 8

Transitive law is used to form the foundation of the consistency tests of the AHP technique. For example, if the relative importance of A1 is two times greater than that of A2 and the relative importance of A2 is three times greater than that of A3, then the relation of importance of A1 need to be six times greater than that of A3. Consistency index (CI) and consistency ratio (CR) are used in the technique of AHP to evaluate the degree of closeness to consistency. It is suggested that a CI or a CR of 0.10 (10%) or less could be considered as a tolerable error in measurement (Benlian 2010; Saaty 1980; Shih and Gong 2010). The CI and CR of each matrix were calculated and given in the assistance of the software of Expert Choice. Moreover, it is suggested that the inconsistency could be improved through asking surveyees to

reconsider the original values in the pairwise comparison matrix or through conducting sensitivity tests in order to eliminate the values which have high inconsistency (Shih and Gong 2010; Tsai and Ho 2009). Considering the limitations of time and resources in this research, sensitivity tests would be carried out in this research.

3.11 Analytic Hierarchy Process Mass Survey

The aim of the AHP mass survey in this phase was to revalidate the priorities and weightings of the dimensions/criteria which were identified by the Modified Delphi panel experts according to the views of the venue operators in the US chain hotel systems.

The MeetingMatrix client base was used to conduct this mass survey research. MeetingMatrix RDS has been recognised as one of the latest and most accurate tools in the event industry for planning by the Professional Convention Management Association (PCMA) (TravelDailyNews 2007). Since 2005 the PCMA Space Verification has used MeetingMatrix RDS as its industry standard (Davis 2005). It was claimed that MeetingMatrix, which was founded in 1988, held approximately 80 per cent of the captured market share in both software and diagramming solutions for the global meeting industry (Business Wire 2005). The company has provided the researcher with access to the MeetingMatrix Customer Resources Management (CRM) system. A support team which included the Vice President of Operations, the Director of Customer Relations, the Director of Marketing and the Director of Sales in MeetingMatrix was assembled to facilitate the assistance to the research. The samples used in this research were from the CRM system and were selected according to stated criteria discussed below.

Starred hotels are considered as one of the most common locations for staging events as power, water and equipped kitchens on the premises with tables, chairs and staging etc. are readily supplied (Malouf 2012). It is estimated by the Center for Exhibition Industry Research (CEIR) that approximately forty percent of tradeshow events were hosted in starred hotels in USA, Canada and Mexico (CEIR 2013). Wu

and Chung (2001) found that the starred hotels which target the market of tradeshow and meeting events generally have the characteristics of large capacity of meeting space, flexibility on the multifunctional rooms and advanced ICT technologies supplied, which echoes to Weber's research (Weber 2000); it is concluded that meeting planners rated the factor of flexibility of the property to accommodate the specifics of their events as one of the most important factors when selecting a brand of chain hotel as their venues for meeting events. It is also found that chain hotels are the major clients of RDS suppliers (MeetingMatrix 2012; Newmarket 2013).

Downs and Mohr (1976) suggest that innovation characteristics could be divided into primary and secondary attributes of innovations. The primary attributes can be measured in standard manners across settings and organisations such as cost or size. However, the secondary attributes are commonly measured through the perceptions of adopters or professionals such as observability or trialability. Different from the primary attributes, the secondary attributes, which are influenced by varied settings and actors implementing a specific innovation, therefore, are difficult to be generalised across a large sample of organisations or geographic locations. It is claimed that homophily, which is the degree to which individuals interact in the context of similar attributes such as language and social characteristics, is a crucial factor affecting the effects and patterns of innovation diffusion (Rogers 2003). For example, social structure, which gives regularity and stability of human behaviour within a system, allows the participants in an innovation adoption to predict behaviour with some degree of accuracy from the behaviour of their peers. Pohjola (2001) found that ICT usage may be affected by the national wealth of different countries. Kraemer et al. (2006) claimed that varied culture and politics such as the rule of law, political openness and property rights in different countries may also be important factors that influence the degree of ICT usage. Even within the developed countries the priorities and importance of the innovation characteristics and economic effectiveness factors of a specific ICT innovation for high-level decision makers varied across countries (Zhu et al. 2006). It was found that due to the varied economic and regulatory conditions among countries, a specific technological innovation such as RDS may have different diffusion patterns and impacts at the

post-adoption stage on the adopting organisations in different countries (Zhu and Kraemer 2005).

Therefore, through the relevant literature review as discussed in Chapter Two, considering the possible effects of heterophily of innovation diffusion across countries and the limitations of time and resources, this project decided to focus on the venues within chain hotels in the USA. Therefore, three criteria have been set which prepare for the sample selection process at this stage in the project: the sample venues used are located in the USA; the sample venues used belong to the hotel sector; the sample hotels used are run within chain systems.

Two hundred email addresses were randomly selected from the MeetingMatrix CRM email database to conduct a pilot test of this AHP mass survey. Issues in terms of the design and structure of the AHP questionnaire raised from the pilot study results would be resolved with amendments to the AHP mass survey. As a result, the final questionnaire of the AHP mass survey (Appendix 11) would be distributed to the targeted venue mangers.

Because of the complexity of the AHP technique, convenience sampling is usually used in relevant research designs such as Crouch's research of identification of destination competitiveness (Crouch 2011). Furthermore, due to the limited research resources in this project, this study could not target the population of every RDS venue manager in the US chain hotels who have used RDS but merely MeetingMatrix users and contacts from the company's database, the targeted venue managers. Therefore, the research results have to been viewed and examined as the results from non-probability sampling (Bryman and Bell 2011; Kitchenham and Pfleeger 2002). It has been reported that any non-random sampling approach used in quantitative research has the limitation of generalisation in the aspect of statistics, even including studies which have high response rates (Ip et al. 2012). Bryman and Bell (2011) argue that the response rate is less of an issue for the studies using non-probability sampling. It is suggested that response rate may not the best way to judge the quality of survey results but representativeness of respondents is more important

(Schouten et al. 2009). In this AHP mass survey several questions which referred to previous literature (Horan 2010; Jones and Baloglu 2006; Karadag et al. 2009; Singh and Kasavana 2005; Zhu et al. 2006) were designed to examine if any evidence exists to suggest that the survey results are unrepresentative of the populations the researcher was trying to study.

3.12 Research Design: the Methods and Structure of this Thesis

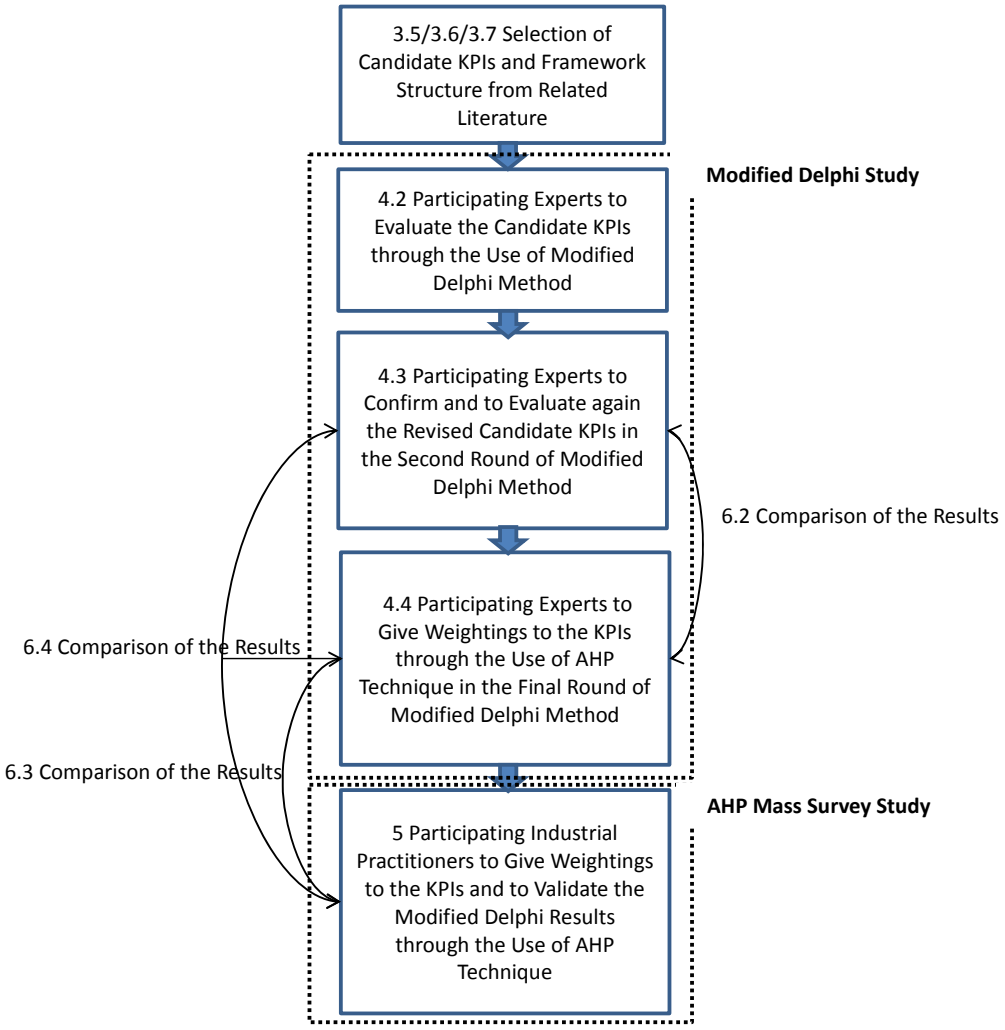

Figure 8 – Research Design: the Methods and Structure of this Thesis

Firstly, through literature review, a hierarchical structure was built, and the candidate KPIs were selected and adapted for this research.

Secondly, the researcher intended to develop this hierarchical framework in consultation with an expert panel. Through the process of the consultation of the expert panel, the operational KPIs were further extracted from the candidate KPIs. Modified Delphi technique was used at this point to facilitate the consultation. The results of the first two rounds of the modified Delphi study helped mainly in the selection process of the KPIs used in the final round which would use a weighting technique, Analytic Hierarchy Process (AHP) (Khorramshahgol and Moustakis 1988). In the last round of the modified Delphi the advanced statistical technique of AHP was implemented in the questionnaire. Through the use of the pairwise comparison technique of AHP, not only could the priorities of the indicators/factor tiers/categories in this Delphi study be validated and compared, but the indicators/factor tiers/categories could also be given weightings within the framework for the construction of a potential index system.

Thirdly, after pilot testing with two hundred representative participants randomly selected from the targeted venue managers, the subsequent modification of the questionnaire resulted in the construction of a final instrument of the AHP mass survey for distribution to the targeted venue managers in order to revalidate and compare the priorities and weightings with the modified Delphi results. The analyses and conclusions from this fundamental data would give weightings to each operational KPI. A specific indicator system for monitoring the productivity and effectiveness of RDS in meeting and event venue operations would be developed. It has been claimed that little innovation diffusion research has focused on the relative contribution of the innovation diffusion characteristics such as compatibility with, and complexity of, the adoption behaviour and the effectiveness of the adoption (Rogers 2003). The research presented intends to bridge this gap in the innovation diffusion research through the implementation of the AHP method.

3.13 Ethical Considerations

This research seeks opinions on an ICT service from an expert panel and venue managers who have volunteered to participate in this research by means of questionnaires. Risk of loss of confidentiality has been considered the most

important ethical issue in this research. However, great care was taken to avoid related ethical risks: disclosure of ethical issues was offered to participants before conducting questionnaires; means of anonymity were given for sensitive opinions or information to protect individuals and their organisations.

In Phase One of the research, an email which explained the aim and context of this research was sent to eligible expert panellists to invite them to participate in this research. Online consent forms were accompanied by an information sheet (Appendix 1). These were returned through the Internet by the participants who indicated that they have read the information sheet. Online questionnaires were given to the panellists for their comments and recommendations by means of Delphi technique. Raw data was kept and stored confidentially at Queen Margaret University. All personal identifying information will be retained for five years after the research program has been completed.

The MeetingMatrix client base was used to conduct Phase Two of the research. The company provided the researcher with access to the MeetingMatrix Customer Resources Management (CRM) system. The samples used in this research were from the CRM system and selected according to stated criteria. Before the researcher sent any survey to MeetingMatrix clients/customers who were selected from the database, MeetingMatrix reviewed the draft introductory emails to the clients/customers in order to authorize the aim and objectives of this research and help to facilitate the data collection. The participants were provided with the rationale as to why they had been chosen for this study. An online questionnaire was given to the participants for their opinions by means of the Analytic Hierarchy Process (AHP). They were given clear instruction as to what was expected from them over the course of the study if they chose to participate. Online consent forms and an information sheet were also sent. These were returned through the Internet by the participants who indicated that they had read the information sheet and agreed to participate.

3.14 Validity and Reliability

Validity in a research project is defined as “the extent to which the research findings accurately reflect the phenomena under study” (Collis and Hussey 2009, p. 64). A measuring instrument used for the phenomena under study can be relatively valid. In the level of research design issues, validity is generally classified into two broad categories: internal validity and external validity (Lewis-Beck et al. 2004). Internal validity concerns the replicability of a research project and if there another reason (cause) that can explain my results (effect). It is claimed that internal validity could be controlled by mitigating the threats and other effects of influences such as selection of sample and outside events during the research period (Keeney et al. 2011). External validity is concerned about the sample representative of the whole population and “whether the study results can be generalized beyond the setting, sample, or time frame for the study” (Lewis-Beck et al. 2004, p. 164). Ideally, researchers would like to maximise both internal and external validity. However, there may need to be some trade-off when designing research regarding this issue. For instance, the selection threat of internal validity could be mitigated by focusing on a homogeneous group in a research project; however, this may result in sacrificing the level of generalisation which is the concern of external validity.

Three basic types of validity of research can be assessed: criterion-related validity; content validity and construct validity (Lewis-Beck et al. 2004). Criterion-related validity is the degree to which a measure correlates with some other measure accepted as an accurate indicator of the concept and is divided into two types: concurrent and predictive. Concurrent validity is established when a test administered at the same time, is correlated with a measure that has been previously shown to be a valid indicator of the concept. It is assumed that the Delphi technique used in a research project contributes to concurrent validity due to the successive rounds and by achieving consensus as the panellists have identified and agreed the components (Keeney et al. 2011). Furthermore, it is claimed that in a research project the Delphi technique, which has demonstrated distinct advantages of forecasting accuracy over traditional group discussions, conferences, brainstorming and other interactive group processes in some previous research comparing methods,

contributes to predictive validity (Keeney et al. 2011; Ono and Wedemeyer 1994; Riggs 1983).

Content validity focuses on the extent to which the "item in the tool samples the complete range of the attribute under study" (DeVon et al. 2007, p. 157). The procedures used for the development of the research instrument could be used to examine content validity. The presented modified Delphi study began with a definition of the concept and how the concept has been defined in the past. It is believed that the following Delphi processes are based on expert opinions from the real world which provides confirmative judgments (Cross 1999). The experts from a renowned Delphi panel reviewed and judged the appropriateness of the indicators. Therefore, it is claimed that the Delphi technique contributes to the establishment of content validity (Huang et al. 2008). The Delphi technique could be used to "yield rich qualitative and rigorous quantitative data resulting in a content validated instrument, possibly resulting in a more in-depth content validation" (Colton and Hatcher 2004, p. 5).

Content validity has been regarded as a necessary precondition for construct validity which concerns the question of what the instrument is in fact measuring (Kent 1999). It is suggested that the construct validity of a measure can be assessed through three distinct but interrelated steps (Lewis-Beck et al. 2004): specify the theoretical relationship between two or more theoretical constructs; the empirical relationship between the measures of the constructs must be examined; the empirical relationship evidence must be interpreted in terms of how it clarifies the construct validity of the particular measure.

In the case of this research the area of interest is to identify a comprehensive set of indicators and dimensions for monitoring and evaluating the economic value and effectiveness of an RDS. Through literature review the theoretical relationships of the proposed indicators were constructed. The relationships were then examined and clarified by a renowned expert panel through a modified Delphi technique. It is claimed that triangulation, which is a process that draws data together from a

combination of different perspectives, can contribute to the establishment of the convergent validity of the construct validity (Thurmond 2001). In this study, the indicators and dimensions were generated and weighted through the processes of literature review, a modified Delphi method and the Analytical Hierarchy Process by an expert panel and a group of targeted venue managers in order to establish a degree of construct validity.

Reliability is defined as the extent to which measurements are repeatable (Kent 1999). There are two major approaches to the assessment of reliability: test-retest reliability and internal consistency of measures (Sekaran and Bougie 2011). Test-retest reliability is assessed by obtaining consistent results through conducting the same measure on one or more occasions over a period of time in order to ensure the reliability of the instrument over time. In this study, the reliability of the data obtained over the research period was ensured through rounds of Delphi technique. As for the internal consistency of measures, Cronbach's coefficient alpha, which is used for multipoint-scaled items and takes the average correlation among items in a scale (e.g. Likert Scale), is used to ensure the items measured fitting together as a set and "being capable of independently measuring the same concept" during the Delphi phase of this research (Sekaran and Bougie 2011, p. 162). In addition, it is believed that useful, meaningful and valuable information provided could help to establish reliability in a piece of research (Graziano and Raulin 2006). In this research the questions presented in the surveys were clearly presented and were adopted and adapted from previous literature and studies (Horan 2010; Jones and Baloglu 2006; Karadag et al. 2009; Singh and Kasavana 2005; Tsai and Ho 2009; Zhu et al. 2006). A glossary based on previous literature (Amit and Zott 2001; Horan 2010; The World Bank 2011) was included with every survey in an attempt to avoid ambiguities (Appendix 2). Online PowerPoint presentations (Appendix 3) regarding the aim, objectives and background of this research were embedded in the online surveys and a personal organiser was offered in order to ensure that every participant could understand and relate to the tasks regardless of their discipline or background (Saizarbitoria 2006).

In addition, transitive law is used to form the foundation of the consistency tests of the AHP technique. For example, if the relative importance of A1 is two times greater than that of A2 and the relative importance of A2 is three times greater than that of A3, then the relation of importance of A1 need to be six times greater than that of A3. Consistency index (CI) and consistency ratio (CR) are used in the technique of AHP to evaluate the degree of closeness to consistency. It is suggested that a CI or a CR of 0.10 (10%) or less could be considered as a tolerable error in measurement (Benlian 2010; Saaty 1980; Shih and Gong 2010). The CI and CR of each matrix were calculated and given in the assistance of the software of Expert Choice (http://expertchoice.com/). Moreover, it is suggested that the inconsistency could be improved through asking surveyees to reconsider the original values in the pairwise comparison matrix or through conducting sensitivity tests in order to eliminate the values which have high inconsistency (Shih and Gong 2010; Tsai and Ho 2009). Considering the limitations of time and resources in this research, sensitivity tests would be carried out in this research.

The Bristol Online Survey system (http://www.survey.bris.ac.uk/) was used to automatically produce accurate records of survey results. IBM SPSS Statistics (http://www-01.ibm.com/software/analytics/spss/) was used to analyse the research data. Expert Choices Software was implemented to calculate the AHP research results. The software which was recommended by previous literature was used in over 1,000 AHP related academic articles and almost 100 doctoral dissertations (Forman and Gass 2001). For example, Kahraman et al. (2007) used the AHP technique and Expert Choices software to prioritise the main goals and relevant subfactors of ICT management for eGovernment strategies. Crouch (2011) used the AHP and Expert Choices package to develop a model for monitoring the destination competitiveness and sustainability in the tourism management domain which integrated 36 evaluated and weighted attributes of competitiveness.

3.15 Alternative Approaches

The selected research methods and designs are not considered to be unconditionally superior or inferior to others but they do have qualities that make them preferable for

some purposes and some research questions (Totland 1997). The selection of a research design is subject to the availability of techniques, procedures, protocols and a sampling plan (Cooper and Schindler 2006). There are several alternative approaches which have been reported that could be implemented for generating ICT indicators such as in-depth interview, focus group and exploratory factor analysis method (Chang 2001; Heeks 2006; Mutula and Brake 2006).

In-depth interview is useful for collecting a wide range of data from a person's opinions, attitudes, values, beliefs, past experience and future intentions (Krishnaswami and Satyaprasad 2010). However, it is argued that the individual in-depth interview approach could be time-consuming, expensive to organise and sometimes difficult to set up (Willis 2000). Under the in-depth interview method there is also no opportunity for interviewees to interact and think creatively. Furthermore, considering the characteristic of geographically dispersed participants in this research, the in-depth interview approach is comparatively impractical to use (Horan 2010; Jones and Hunter 1995).

The focus group meeting is a group discussion where the investigator attempts to use a set of questions to move the discussion toward concepts of interest to the researcher (Krishnaswami and Satyaprasad 2010). However, it is reported that some group participants under this approach may feel psychologically pressured by the more influential dominant participants in a focus group meeting (Keeney et al. 2011). Face-to-face meetings for decision making may cause group bias and group think scenarios which are dominated by influential and strong-minded individuals. Therefore, it is recommended that the focus group method may not be suitable for use when there is an intention to get people to come to consensus (Lewis-Beck et al. 2004). In contrast, the anonymity provided by the Delphi method offers an equal chance for each participant to present and to react to ideas unbiased by the identities of other panel members, thus resulting in open and truthful responses (Goodman 1987). It is claimed that the reactions are then given equal importance in the analysis which follows, and therefore, subject bias is relatively reduced (Keeney et al. 2011).

Exploratory factor analysis is a mathematical method which attempts to confirm a proposed factor structure, and the goal of this method is to find a way to represent monitored data in fewer factors (Baggio and Klobas 2011). It has been found that the objective data on ICT payoffs is sometimes unavailable and inadequate for researchers (Brynjolfsson and Hitt 2003; Tallon et al. 2000). Zhu and Kraemer (2005) argue that due to the developing unique Internet characteristics of eBusiness, some related impact indicators are under development and not yet being monitored. As the first step of RDS productivity and effectiveness research, this study is, therefore, focused on the development of a tailored indicator framework as suggested by previous ICT innovation diffusion research (Chau and Tam 1997; Rogers 2003; Swanson 1994; Zhu et al. 2006).

Chapter 4 – Modified Delphi Study Results

Chapter 4 – Modified Delphi Study Results

4.1 Introduction

This chapter provides the findings from the modified Delphi study which was conducted between 17th November 2011 and 20th August 2012. The aim of this modified Delphi study was to generate a comprehensive set of dimensions for the evaluation of the economic value and effectiveness of RDS. Through identifying key stakeholders' views on the criteria used to measure RDS system effectiveness, the developed framework can be used to monitor the post-adoption economic value and effectiveness of RDS.

4.2 Modified Delphi Study – Round One

As discussed in 3.8.1, 33 identified Delphi experts agreed to participate in this study. In the first round of this modified Delphi research, the potential KPIs list was distributed to the 33 panellists through an electronic survey between 17th November 2011 and 28th February 2012. The Bristol Online Survey system was used to construct the survey (Appendix 4). The five-point Likert scale (1: Strongly Disagree; 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly Agree) was adopted to detect how strongly the experts agree or disagree with the KPIs that should be included in an evaluation framework to monitor the effectiveness of the RDS in value creation processes at meeting/event venues. Each member of the Delphi expert panel then answered the questionnaire individually. After the first round, an anonymous summary of the experts' forecasts from the previous round was provided. In this way, experts could refer to their earlier answers and consider revision in the light of the replies of other members of this expert panel (Keeney et al. 2011). It was hoped that a degree of consensus could be reached through this process. In addition, the experts were also asked to provide their comments or if there were any amendments or additions that they would like to make to the framework and the KPIs.

In the first round of this modified Delphi research, some of the contacts had asked to be removed from the "expert" panel as they did not feel qualified to answer the survey after reviewing the questions. It is suggested that follow-up reminder

messages could increase response rates in email surveys (Sheehan 2001). Therefore, three follow-up reminder messages were transmitted electronically. As a result, 18 (54.5%) contacts effectively responded to the survey. They were classified into three categories: Venue (9), Academic (6) and Consultant (3) for further comparison analyses. The background of these panel members can be seen in Table 13.

Table 13 – Modified Delphi Expert Panel Background

Academic	Boston University, USA
	Ivy Tech Community College of Indiana, USA
	Mason University, USA
	Metropolitan State University of Denver, USA
	The Hong Kong Polytechnic University, China
	University of Alabama, USA
Venue	Capital Hilton Hotel, Washington, DC, USA
	Carefree Resort & Conference Centre, Carefree, Arizona, USA
	Hawaii Convention Centre, USA
	Hilton Hotel, Clearwater, Florida, USA
	Sacramento Public Library, California, USA
	Seaport Hotel, Boston, Massachusetts, USA
	Sevierville Convention Centre, Tennessee, USA
	The Ritz-Carlton Hotel, Jamaica
	The Woodlands Waterway Marriott Hotel & Convention Centre, The Woodlands, Texas, USA
Consultant	ConferenceDirect, Los Angeles, California, USA
	Special Event Boot Camp, Toronto, Canada
	Tastefully Simple, Alexandria, Minnesota, USA

It is suggested that self-assessment of experts' level in the knowledge fields is an often used approach to understand and to justify the quality of a Delphi study (Keeney et al. 2011). Two questions with a knowledge level table (Table 14) were designed in this first round survey to investigate participants' knowledge level of ICT and RDS effectiveness based on their awareness, reading or working. Both the average scores of ICT effectiveness (2.4) and RDS effectiveness (2.7) were self-evaluated between Advanced (2) and Competent (3) level suggesting that the 18 experts can provide quality comments and results to this modified Delphi study.

Table 14 – Self-assessment Expert Level Table

Expert (1)	I consider myself to belong to the community of people who currently dedicate themselves to the topic matter, and are recognised outside of my organisation as having a strong grasp of trends or other aspects of the topic.
Advanced (2)	1) I were once an expert but feel somewhat rusty now, or 2) I am in the process of becoming an expert but still have some way to go to achieve mastery of the topic, or 3) I work in a neighbouring field and occasionally draw upon or contribute to the development of the topic.
Competent (3)	I feel I have a proficient level of knowledge about the topic. I have read about the topic and formed some opinions about it.
Casually acquainted (4)	I have read or heard about the topic in the media or other popular presentations.
Unfamiliar (5)	I consider myself unfamiliar with the topic area.

Source: Horan (2010)

The average score of importance, the standard deviation and cumulative percentage for each indicator, was calculated as seen in Table 15. The cumulative percentage reveals that the degree of consensus on the KPI has been reached (i.e. 70% indicates that 70% of the members of the Delphi panel voted either 'Agree' or 'Strongly Agree'). From the result of this initial round survey, "Satisfaction of meeting/event planners", "Quality of relationship with meeting/event planners (e.g. Wedding planners)" and "Quality of relationship with meeting/event service suppliers (e.g. Catering service suppliers)" were rated by the 18 panellists as the top three Key Performance Indicators (KPIs) among the 30 candidate KPIs when evaluating the economic value and effectiveness of RDS products and services for venue operators, as can be seen from Table 15. The factor tier C of the impact on business partner relationships within the category of the RDS value in particular was rated as being most essential when monitoring the economic value and effectiveness of RDS, a specific ICT application at meeting/event venues. There were two factor tiers which were also rated highly: factor tier E of compatibility (the degree to which an

innovation is consistent with existing business processes, practice and value systems) and factor tier I of the technology competence (the existing technologies in use and relevant technical skills available in the organisation). However, factor tier F of the complexity (the degree to which an innovation is difficult to use) was rated as being the least important.

Table 15 – Modified Delphi First Round Results

Key Performance Indicator	**Round One**			
	Importance Rating			
	N= 18 (Delphi Panel Size)			
	Mean	*SD*	*CP*	*R*
D3_Satisfaction of meeting/event planners	4.67	0.59	94.40%	1
C2_Quality of relationship with meeting/event planners (e.g. Wedding planners)	4.44	0.71	88.90%	2
C1_Quality of relationship with meeting/event service suppliers (e.g. Catering service suppliers)	4.44	0.71	88.90%	2
I3_Skill Development: the extent to which the meeting/event venue has implemented the following in order to help employees develop e-business skills- (a) in-house training; (b) participation in ICT training such as courses and seminars run by third parties; (c) designating certain work time for ICT learning/training; (d) establishing self-learning or e-learning programs; (e) recruiting staff with special ICT skills	4.11	0.68	83.40%	4
E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate culture and value systems	4.11	0.76	77.70%	5
E1_RDS products and services are compatible with the meeting/event venues' current selling processes	4.11	1.02	77.70%	5
I2_ICT Skills: the extent to which the majority of the employees in the meeting/event venue are capable of using the following applications-web browser, intranet, online Request for Proposal (RFP) processing	3.89	0.96	72.20%	7
I1_ICT Infrastructure: the strength of existing ICT infrastructure, as measured by related technologies that the meeting/event venue has in place, including electronic data interchange (EDI), intranet, extranet, local area network (LAN), wide area network (WAN)	3.83	0.92	72.20%	7
A2_Booking rate at the meeting/event venue	3.89	1.23	72.20%	7
B2_Costs per labour hour	3.89	1.41	66.70%	10
B3_Costs of coordinating business partners	3.44	1.1	66.70%	10
D1_Satisfaction of meeting/event guests	4	0.97	66.70%	10
E2_RDS products and services are compatible with the existing distribution channels	3.78	0.81	66.70%	10
J2_Financial Commitment	3.78	1.06	66.70%	10
B1_Costs of internal processes and labour costs	3.72	1.27	61.10%	15
D2_Quality of relationship with meeting/event guests	3.78	0.94	55.60%	16
A1_Number of new guests through ICT application	3.5	1.1	55.60%	16
A4_Sales per labour hour	3.33	1.24	50.00%	18
J3_Organisational Type: hotel star- 0/1/2/3/4/5	3.56	1.2	50.00%	18
K1_Perceived Competitive Pressure: percentage of competitors in the city of the meeting/event venue that have adopted ICT room diagramming solutions	3.33	1.24	50.00%	18

K2_Perceived Stakeholder Pressure: the extent to which downstream customers (meeting/event planners) have e-business systems ready to support ICT room diagramming solutions	3.33	1.09	50.00%	18
A3_Regional market share	3.33	0.97	50.00%	18
H1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to experiment with (e.g. In the websites of the venues)	3.61	0.98	50.00%	18
F1_Cost of integrating RDS products and services to the venues' sales (including hardware, software, training, organisational restructuring, business process reengineering)	3.72	0.96	50.00%	18
F4_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event planners	3.39	1.29	50.00%	18
B4_Marketing costs	3.44	0.92	44.40%	26
F2_Training hours to the operators in the meeting/event venues for the application of RDS products and services	3.56	1.2	44.40%	26
G1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to search for (e.g. In the websites of the venues)	3.39	1.15	38.90%	28
J1_Organisation Size: number of employees in the meeting/event venue	3.33	1.19	38.90%	28
F3_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event venue staff	3.44	1.1	38.90%	28

SD=Standard Deviation; CP=Cumulative Percentage ; R=Ranking

Every individual proposed KPI received a mean score of between 3.33 and 4.67(3: Neutral; 4: Agree; 5: Strongly Agree). The results demonstrated a high level of satisfaction with the proposed KPIs. More than half (17) proposed KPIs had a standard deviation of less than 1.1 indicated in the first round of modified Delphi results, a degree of consistency among the panel in the mean scores achieved. However, over fifty comments and feedback items for the drafted indicators were received from the first round study. The majority of these suggestions, nevertheless, focused on clarifications of the wordings and practical phrases used in the industry when defining the indicators. For example, it was suggested by the expert panel members that the “new guests” in the proposed KPI A1 need to be defined; the “regional mark share” in the KPI A3 needs to be defined; the “distribution channels” in the KPI E2 need to be clarified. It was also suggested that the cost of measuring the rooms and creating scaled diagrams should be included in the definition of the KPI F1, and the size of the facility and the amount of diagramable spaces, which

means the spaces in the venues which can be measured and used to create room diagrams, should be included in factor tier J. Moreover, it is suggested that the indicator of J3_Organisational Type (hotel star- 0/1/2/3/4/5) may be adjusted to a new definition which reflects organisations' ICT related context and includes size of facility. Only one additional KPI was suggested to add to the framework (J4_International Scope: the extent of conducting business in international markets (i.e. the extent to which clients come from different countries)). The detail comments can be found in Appendix 5. Considering these invaluable comments from the first round modified Delphi expert panel in Appendix 5, a revised KPIs list was prepared in the light of the reflection of the comments. The reflection and the results of the analyses of the comments are demonstrated in Table 16 and is ready for round two of the modified Delphi study.

Table 16 – Revised KPIs Based on Comments from the Modified Delphi First Round

Revised KPIs	Original Proposed KPIs
A1_**Increased** number of new **clients (i.e. meeting/event planners who use the venue for the first time because of the availability of Internet room diagramming solutions)**	A1_Number of new guests through ICT application
A2_Booking rate at the meeting/event venue	A2_Booking rate at the meeting/event venue
A3_Regional market share **(i.e. within a city)**	A3_Regional market share
A4_Sales per labour hour	A4_Sales per labour hour
B1_Costs of internal processes and **labour costs**	B1_Costs of internal processes
B2_**Total labour working hours for making meeting and event spaces set up ready**	B2_Costs per labour hour
B3_Costs of coordinating business partners **(i.e. meeting/event planners or decoration service suppliers)**	B3_Costs of coordinating business partners
B4_Marketing costs **(i.e. conducting marketing campaigns for the promotion of meeting/event room spaces)**	B4_Marketing costs
C1_**Interactive service** quality with meeting/event service suppliers (e.g. catering or **decoration** service suppliers)	C1_Quality of relationship with meeting/event service suppliers (e.g. Catering service suppliers)
C2_**Interactive service** quality with meeting/event planners (e.g. wedding or **exhibition** planners)	C2_Quality of relationship with meeting/event planners (e.g. Wedding planners)
D1_Satisfaction **level** of meeting/event guests **directly attributable to functionality of meeting/event room's set up**	D1_Satisfaction of meeting/event guests

D2_**Interactive service** quality with meeting/event guests **(e.g. with accessibility of meeting/event room's set up and utilization of space**)	D2_Quality of relationship with meeting/event guests
D3_Satisfaction of meeting/event planners	D3_Satisfaction of meeting/event planners
E1_RDS products and services are compatible with the meeting/event venues' current selling processes **(i.e. catering program)**	E1_RDS products and services are compatible with the meeting/event venues' current selling processes
E2_RDS products and services are compatible with the existing distribution channels **(i.e. the venues' websites)**	E2_RDS products and services are compatible with the existing distribution channels
E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate culture and value systems
F1_Cost of integrating RDS products and services to the venues' sales (including hardware, **measuring the rooms, creating scaled diagrams**, software, training, organisational restructuring and business process reengineering)	F1_Cost of integrating RDS products and services to the venues' sales (including hardware, software, training, organisational restructuring, business process reengineering)
F2_Training hours to the operators in the meeting/event venues for the application of RDS products and services	F2_Training hours to the operators in the meeting/event venues for the application of RDS products and services
F3_The degree to which RDS products and services are **complex** and difficult to use in the perceptions of meeting/event venue staff	F3_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event venue staff
F4_The degree to which RDS products and services are **complex** and difficult to use in the perceptions of meeting/event planners	F4_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event planners
G1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues' **websites as visible and easy to find (i.e. how many transferring web pages needed from the venue's web front page to the page hosting RDS products and services)**	G1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to search for (e.g. In the websites of the venues)
H1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues' **websites as easy to experiment with and try (i.e. what waiting time is needed to install or log into the trial version of RDS products and services from the hosting downloadable page)**	H1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to experiment with (e.g. In the websites of the venues)
I1_ICT Infrastructure: the strength of existing ICT infrastructure, as measured by related technologies that the meeting/event venue has in place, including electronic data interchange(EDI), intranet, extranet, local area network (LAN), wide area network (WAN)	I1_ICT Infrastructure: the strength of existing ICT infrastructure, as measured by related technologies that the meeting/event venue has in place, including electronic data interchange (EDI), intranet, extranet, local area network (LAN), wide area network

	(WAN)
I2_ICT Skills: the extent to which the majority of the employees in the meeting/event venue are capable of using the following applications - web browser, intranet, online Request for Proposal (RFP) processing and **the existence of in-house IT department or support**	I2_ICT Skills: the extent to which the majority of the employees in the meeting/event venue are capable of using the following applications - web browser, intranet, online Request for Proposal (RFP) processing
I3_Skill Development: the extent to which the meeting/event venue has implemented the following in order to help employees develop eBusiness skills such as (a) in-house training; (b) participation in ICT training such as courses and seminars run by third parties; (c) designating certain work time for ICT learning/training; (d) establishing self-learning or e-learning programs; (e) recruiting staff with special ICT skills	I3_Skill Development: the extent to which the meeting/event venue has implemented the following in order to help employees develop eBusiness skills such as (a) in-house training; (b) participation in ICT training such as courses and seminars run by third parties; (c) designating certain work time for ICT learning/training; (d) establishing self-learning or e-learning programs; (e) recruiting staff with special ICT skills
J1_Organisation Size: number of employees in the meeting/event venue	J1_Organisation Size: number of employees in the meeting/event venue
J2_Financial Commitment: ICT operating, **software and space measurement budget**, as percentage of total revenue	J2_Financial Commitment: ICT operating budget, as percentage of total revenue
J3_Organisational **Scope: amount and size of diagramable spaces in the venue**	J3_Organisational Type: hotel star-0/1/2/3/4/5
J4 International Scope: the extent of conducting business in international markets (i.e. the extent to which clients come from different countries)	-
K1_Perceived Competitive Pressure: percentage of competitors in the city of the meeting/event venue that have adopted ICT room diagramming solutions **and the predicted ICT room diagramming solutions forthcoming investments of important competitors**	K1_Perceived Competitive Pressure: percentage of competitors in the city of the meeting/event venue that have adopted ICT room diagramming solutions
K2_Perceived Stakeholder and Social Pressure: the extent to which downstream customers (meeting/event planners) **expect ICT room diagramming solutions to be used** and have eBusiness systems ready to support the services	K2_Perceived Stakeholder Pressure: the extent to which downstream customers (meeting/event planners) have eBusiness systems ready to support ICT room diagramming solutions

In the first round survey results, reliability analysis (Cronbach's Alpha) was 0.85 for the overall 30 proposed KPIs suggesting internal consistency which indicates the reliability of the research instrument employed was high (Hair et al. 1998).

4.3 Modified Delphi Study – Round Two

In order to confirm a correct set of the identified proposed indicators in the first round modified Delphi study, it was necessary to revalidate the proposed indicators which had been carefully revised based on the suggestions from the previous round of the Delphi panel. In the second round survey, an anonymous summary table of the first round findings, including the average score of importance, the standard deviation and cumulative percentage for each indicator, was presented to the panel members. Cumulative percentage reveals that a degree of consensus on the KPI has been reached (i.e. 70% indicates that 70% of the members of the Delphi panel voted either 'Agree' or 'Strongly Agree'). In addition, the individual result for each indicator from the previous round was also embedded along with the research questions of the second round electronic questionnaire for the Delphi panellists' reference when revalidating these revised indicators. The Delphi panellists had also been informed of the previous round results with instructions that they may consider taking these findings into account in their revalidated responses or they may ignore them (Keeney et al. 2011). The glossary which was an attempt to avoid ambiguities was extended, and the requests for clarifications to some technical terms and the suggestions from the first round expert panel were taken and included in the second round survey instrument (Appendix 6).

It is argued that in a Delphi study which has many rounds of survey it may be difficult to retain a high response rate: for example, in a Delphi study conducted by Day and Bobeva (2005) a 40% dropout rate was experienced after the first round. The panel members may need to be rewarded in a way which encourages continuing responses (Keeney et al. 2011). However, it is suggested that ethical considerations should be taken into account when encouraging responses and the participants should not feel 'forced' to continue (Beretta 1996). An appropriate feedback report which highlighted the ongoing importance of each individual panel member's contribution to this project as suggested by previous literature (Sandrey and Bulger 2008) was provided in the follow-up reminder messages in an attempt to keep the members of the expert panel interested and involved.

The second round modified Delphi study was conducted between 14th May and 20th June 2012. Although three follow-up reminder messages were transmitted electronically to non-respondents in order to encourage responses, 11 of the 18 panel members (61.1%) effectively replied to the second round survey. The results of the second round modified Delphi survey, which can be seen in Table 17 reconfirm and strengthen the findings from the first round. The number of the standard deviations of less than 1.1 among the 31 revised KPIs increased to 26 in the second round survey (17 in the first round study) suggesting an improved degree of consistency among the panel in the mean scores achieved through the Delphi survey approach. The number of the received comments and suggestions to the revised KPIs decreased to nineteen as detailed in Appendix 7 (over fifty in the first round study). Many of these comments were expressing agreement on the improvements made on the revised KPIs: for example "A1 is now a much clearer statement", "H1 is now easy to understand" and "these revised items are much clearer. Great progress!" (Unique Response Number: 9215843). The improved standard deviations and decreased number of comments for the majority of the indicators suggest that the Delphi panellists tended to reach a level of consensus on the proposed revised KPIs which could be used in the evaluation of RDS effectiveness.

Comparing the first four KPIs which were highly ranked in the first two rounds, three out of the four were the same. These indicators were: C2_Interactive service quality with meeting/event planners (e.g. wedding or exhibition planners); C1_Interactive service quality with meeting/event service suppliers (e.g. catering or decoration service suppliers); D3_Satisfaction of meeting/event planners. RDS was identified typically as assisting in the generation of digital graphic room layouts for both the meeting and event venue operators and their clients, meeting and event planners. The findings from the first two rounds of the modified Delphi study confirm with the findings from previous literature, where RDS was regarded as an important communication platform for business partners (Bowdin et al. 2010; Silvers 2012). The expert panel regarded that the framework which will be used to monitor the post-adoption economic value and effectiveness of RDS should highlight the

indicators involving the evaluations of quality with and satisfaction of these business partners.

In the second round survey results, reliability analysis (Cronbach's Alpha) was 0.71 for the overall 31 proposed KPIs suggesting internal consistency which indicates the reliability of the research instrument employed was moderate (Hair et al. 1998).

In the two surveys, the three categorized panellists (Venue; Academic; Consultant) show slightly different preferences in their priorities for these proposed KPIs. However, in terms of the top four rated KPIs, there was a common focus on the "Interactive service quality with meeting/event planners (e.g. Wedding or exhibition planners)", "Satisfaction of meeting/event planners" and "Quality of relationship with meeting/event service suppliers (e.g. Catering service suppliers)" in both rounds.

Table 17 – A Comparison of Second and First Round Delphi Survey Results

Key Performance Indicator	**Round Two**				**Round One**			
	Importance Rating				**Importance Rating**			
	N= 11 (Delphi Panel Size)				**N= 18 (Delphi Panel Size)**			
	Mean	*SD*	*CP*	*Ranking*	*Mean*	*SD*	*CP*	*Ranking*
C2_Interactive service quality with event planners	4.73	0.47	100.00%	1	4.44	0.71	88.90%	2
I2_ICT Skills	4.18	0.41	100.00%	1	3.89	0.96	72.20%	7
C1_Interactive service quality with event service suppliers	4.36	0.67	91.00%	3	4.44	0.71	88.90%	2
D3_Satisfaction of meeting/event planners	4.64	0.67	90.90%	4	4.67	0.59	94.40%	1
D2_Interactive service quality with event guests	4.18	0.75	81.90%	5	3.78	0.94	55.60%	16
B3_Costs of coordinating business partners	4	0.89	81.80%	6	3.44	1.1	66.70%	10
E1_RDS products and services are compatible with the event venues' current selling processes	3.91	0.54	81.80%	6	4.11	1.02	77.70%	5
B1_Costs of internal processes and labour costs	4	1	72.80%	8	3.72	1.27	61.10%	15
E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems	4	1	72.80%	8	4.11	0.76	77.70%	5
I1_ICT Infrastructure	4	0.78	72.80%	8	3.83	0.92	72.20%	7
B2_Total labour working hours	4.18	1.08	72.70%	11	3.89	1.41	66.70%	10
J3_Organisational Scope: amount and size of diagramable spaces in the venue	3.73	0.79	72.70%	11	3.56	1.2	50.00%	18

A2_Booking rate at the meeting/event venue	3.91	0.7	72.20%	13	3.89	1.23	72.20%	7
D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up	4	0.89	63.70%	14	4	0.97	66.70%	10
E2_RDS products and services are compatible with the existing distribution channels	4	0.89	63.70%	14	3.78	0.81	66.70%	10
A4_Sales per labour hour	3.73	0.91	63.70%	14	3.33	1.24	50.00%	18
I3_Skill Development	3.73	1.1	63.70%	14	4.11	0.68	83.40%	4
K2_Perceived Stakeholder and Social Pressure	3.55	0.69	63.60%	18	3.33	1.09	50.00%	18
H1_Trialability	3.36	0.92	63.60%	18	3.61	0.98	50.00%	18
B4_Marketing costs	3.55	1.04	54.60%	19	3.44	0.92	44.40%	26
G1_Observability	3.55	1.04	54.60%	19	3.39	1.15	38.90%	28
K1_Perceived Competitive Pressure	3.55	1.04	54.60%	19	3.33	1.24	50.00%	18
A1_Increased number of new clients	3.45	1.21	54.60%	19	3.5	1.1	55.60%	16
J2_Financial Commitment	3.36	0.81	54.50%	24	3.78	1.06	66.70%	10
J1_Organisation Size	3.45	0.82	45.50%	25	3.33	1.19	38.90%	28
F3_The degree to which RDS products and services are complex and difficult to use in the perceptions of meeting/event venue staff	3.09	1.14	45.50%	25	3.44	1.1	38.90%	28
A3_Regional market share	3.36	0.51	36.40%	27	3.33	0.97	50.00%	18
J4_International Scope	3.36	1.03	36.40%	27	-	-	-	-

F1_Cost of integrating RDS products and services to the venues' sales	3.18	0.98	36.40%	27	3.72	0.96	50.00%	18
F2_Training hours to the operators in the meeting/event venues for the application of RDS products and services	3.18	1.17	36.40%	27	3.56	1.2	44.40%	26
F4_The degree to which RDS products and services are complex and difficult to use in the perceptions of meeting/event planners	2.82	1.47	27.30%	31	3.39	1.29	50.00%	18

SD=Standard Deviation; CP= Cumulative Percentage

The Delphi approach used in this research attempts to achieve consensus on an important issue through a multi-staged survey to a panel of experts (McKenna 1994). A pre-determined consensus level, therefore, needs to be set in this attempt (Keeney et al. 2011). It is suggested that consensus could be defined as being achieved in a variety of ways, for example: a level of standard deviation (Greatorex and Dexter 2000), median (Brooks 1979) or aggregation of the judgements of respondents (McKenna et al. 2002). Considering the purpose of this research which is to identify the views of the majority of key stakeholders, the attainment of a certain level of agreement (or majority rule) was adopted as a measurement of consensus in this Delphi study: consensus on each item was equated with at least 51% (on the measurement of Cumulative Percentage in this research) which was suggested as a cut-off point by previous literature (Loughlin and Moore 1979; Powell 2003). Therefore, items rated below this level by panel members in this second round would be discarded in the next round (Keeney et al. 2011).

4.4 Modified Delphi Study – Round Three

It is claimed that an evaluation model for ICT applications should not only indicate what is important to be measured but also each measurement should be weighted (Horan 2010). In traditional measurement such as the Likert Scale, where elements or factors are scaled one by one and individually, the potential connections among these factors are ignored. Analytic Hierarchy Process (AHP) technique mainly supplies a method, based on human biology and psychology, to improve and advance the conventional approaches through a paired comparison concept. The relative values of each factor could be derived from the judgments which use numerical values taken from the AHP absolute fundamental scale. The priorities (weightings) among the factors in a homogeneous cluster with respect to their hierarchical parent are generated by this approach. Thus, the issues of measuring performance, setting priorities, structuring and synthesis in multi-criteria models could be dealt with through the application of AHP.

The aim of this final-round survey is to attempt to prioritize and to give weightings to the list of criteria tested and generated from the previous rounds. The results of the second round Delphi survey were, therefore, arranged in the format of AHP pairwise comparisons. According to the feedback from the expert panel and the pre-set consensus level requirement (51% on the measurement of Cumulative Percentage), the 31 candidate KPIs have been reduced to 24. An AHP questionnaire (Appendix 8) was designed and distributed to the expert panel, and the third round of the modified Delphi was conducted between 13th July and 20th August 2012. An anonymous summary table of the second round findings, including the average score of importance, the standard deviation and cumulative percentage for each indicator, was presented to the panel members. In addition, the individual result for each indicator from the previous round was also embedded along with the research questions of the second round electronic questionnaire for the Delphi panellists' reference when giving weightings to these revalidated indicators.

Although three follow-up reminder messages were sent out to non-respondents in order to encourage responses, 6 of the 18 panel members (33.3%) effectively replied

to the second round survey. Transitive law is used to form the foundation of the consistency tests of the AHP technique. For example, if the relative importance of A1 is two times greater than that of A2 and the relative importance of A2 is three times greater than that of A3, then the relation of importance of A1 need to be six times greater than that of A3. Consistency index (CI) and consistency ratio (CR) are used in the technique of AHP to evaluate the degree of closeness to consistency. It is suggested that a CI or a CR of 0.10 (10%) or less could be considered as a tolerable error in measurement (Benlian 2010; Saaty 1980; Shih and Gong 2010). The CI and CR of each matrix were calculated and given in Table 18 respectively in the assistance of the software of Expert Choice version 11.5.1815. All CI and CR values in Table 18 are lower or equal to 0.10 except for Factor Tier B_Impact on Efficiency (CR=0.11) and Factor Tier D_Impact on Customer Satisfaction (C R=0.12). It is suggested that the inconsistency could be improved through asking surveyees to reconsider the original values in the pairwise comparison matrix or through conducting sensitivity tests in order to eliminate the values which have high inconsistency (Shih and Gong 2010; Tsai and Ho 2009). Considering the limitations of time and resources in this research, the sensitivity tests for Factor Tier B_Impact on Efficiency and Factor Tier D_Impact on Customer Satisfaction were conducted in order to improve the CI and CR as seen in Table 19. It is found by eliminating values from a specific survey (Unique Response Number: 9564616) in Factor Tier B_Impact on Efficiency, the adjusted CR can be improved to the suggested tolerable level (CI=0.05; CR=0.06). By eliminating values from a specific survey (Unique Response Number: 9661684) in Factor Tier D_Impact on Customer Satisfaction, the adjusted CR can be improved (CI=0.02; 0.03). The adjusted weightings of the categories, factor tiers and KPIs are given in Figure 9 and Table 20 respectively in the assistance of the software of Expert Choice (Appendix 9).

Table 18 – AHP Consistency Tests for the Third Round Delphi Results

Level	CI	Consistency Test	CR	Consistency Test
Set Goal	0.04	Accepted	0.07	Accepted
Category One: RDS Value	0.01	Accepted	0.01	Accepted
Factor Tier A_Impact on Sales	0.00	Accepted	-	-
Factor Tier B_Impact on Efficiency	0.10	Accepted	0.11	Rejected
Factor Tier C_Impact on Business Partner Relationships	0.00	Accepted	-	-
Factor Tier D_Impact on Customer Satisfaction	0.07	Accepted	0.12	Rejected
Category Two: RDS Innovation Diffusion Characteristics	0.00	Accepted	-	-
Factor Tier E_Compatibility	0.05	Accepted	0.09	Accepted
Factor Tier GH_Observability and Trialability	0.00	Accepted	-	-
Category Three: ICT Usage	0.06	Accepted	0.10	Accepted
Factor Tier I_Technology Competence	0.02	Accepted	0.03	Accepted
Factor Tier J_Organisational Context	0.00	Accepted	-	-
Factor Tier K_External Environmental Context	0.00	Accepted	-	-

CI= Consistency Index; CP= Consistency Ratio

Table 19 – CI Sensitivity Tests for Factor Tier B and Factor Tier D

Unique Response Number	Factor Tier B	Factor Tier D
9480528	0.09	0.04
9564616	0.05	0.07
9564980	0.17	0.08
9587235	0.11	0.14
9636555	0.08	0.13
9661684	0.12	0.02

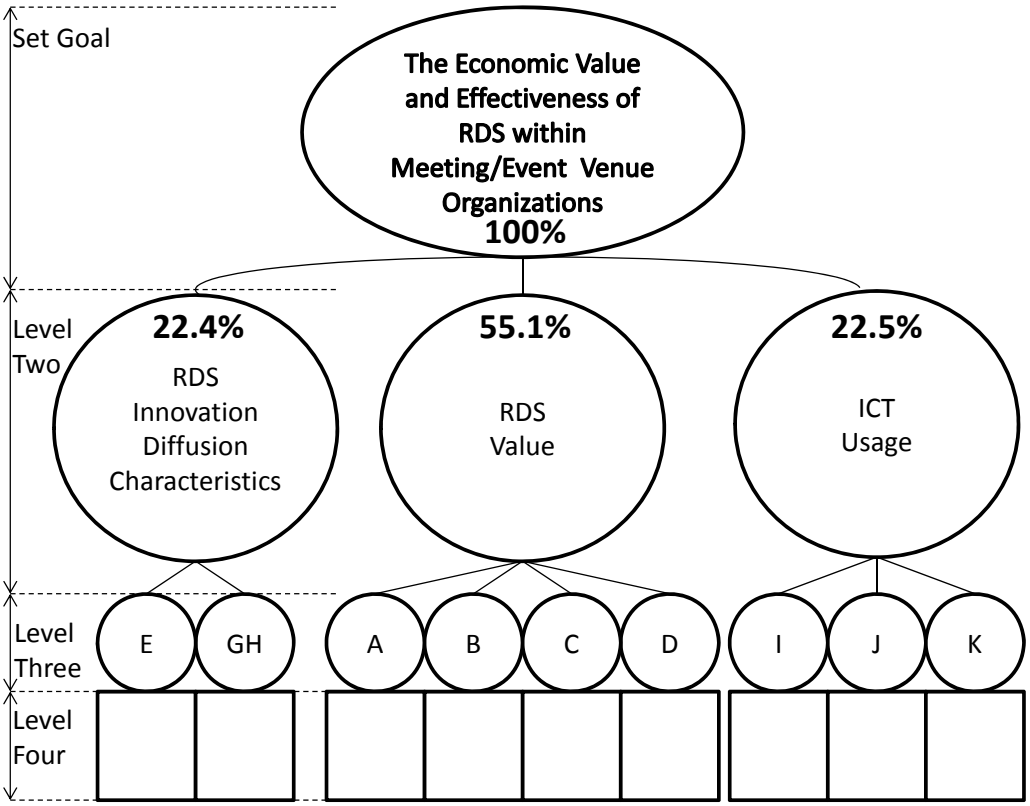

Figure 9 – The Adjusted Weighted Categories

Table 20 – The Adjusted Weighted Key Performance Indicators

Factor Tier	Weighting		Key Performance Indicator
	at Level Three	at Level Four	
Factor Tier **A_ Impact on Sales**	**12.7%**	**4.6%**	A1_Increased number of new clients
		4.2%	A2_Booking rate at the meeting/event venue
		3.9%	A4_Sales per labour hour
Factor Tier **B_ Impact on Efficiency**	**12.3%**	**2.4%**	B1_Costs of internal processes and labour costs
		4.6%	B2_Total labour working hours
		3.7%	B3_Costs of coordinating business partners
		1.6%	B4_Marketing costs
Factor Tier **C_ Impact on Business Partner Relationships**	**7.6%**	**1.5%**	C1_Interactive service quality with meeting/event service suppliers
		6.1%	C2_Interactive service quality with meeting/event planners
Factor Tier **D_ Impact on Customer Satisfaction**	**22.5%**	**3.5%**	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up
		7.8%	D2_Interactive service quality with meeting/event guests
		11.2%	D3_Satisfaction of meeting/event planners
Factor Tier **E_ Compatibility**	**11.8%**	**2.7%**	E1_RDS products and services are compatible with the event venues' current selling processes
		4.3%	E2_RDS products and services are compatible with the existing distribution channels
		4.8%	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems
Factor Tier **GH_ Observability and Trialability**	**10.6%**	**6.4%**	G1_Observability
		4.2%	H1_Trialability
Factor Tier **I_ Technology Competence**	**11.9%**	**4.6%**	I1_ICT Infrastructure
		4.2%	I2_ICT Skills
		3.1%	I3_Skill Development
Factor Tier **J_ Organisational Context**	**6.9%**	**2.2%**	J2_Financial Commitment
		4.7%	J3_Organisational Scope

Factor Tier **K_ External Environmental Context**	**3.6%**	**2.3%**	K1_Perceived Competitive Pressure
		1.3%	K2_Perceived Stakeholder and Social Pressure

It has been reported that experiencing dramatically poor response rates may be a characteristic of the final round of the Delphi technique (Keeney et al. 2011). It is argued that there are no specific guidelines regarding an acceptable response rate for Delphi studies; however, in a Delphi study with a low response rate non-response bias may enter into the study results. The six members of the expert panel who responded to the third round AHP survey were identified in the second round responses, and their ratings to the KPIs in the second round were compared with the third round results as shown in Table 21. It could be found that though different priority techniques were used in the two rounds, there is consistency existing in the priorities of KPIs in Factor Tiers C_Impact on Business Partner Relationships, D_ Impact on Customer Satisfaction and H_Organisational Context.

Table 21 – Ranking Comparisons among Delphi Round Three and Two

Factor Tier	**KPIs**	**Delphi Round Three (AHP Pairwise Comparison)**	**Delphi Round Two (Likert Scale) Importance Rating**	**Delphi Round Two (Likert Scale) Importance Rating**
		N=6	**N=6 (also responded in AHP)**	**N=11**
Factor Tier **A_ Impact on Sales**	A1_Increased number of new clients	1	3	3
	A2_Booking rate at the meeting/event venue	2	1	1
	A4_Sales per labour hour	3	1	2
Factor Tier **B_ Impact on Efficiency**	B2_Total labour working hours	1	2	1
	B3_Costs of coordinating business partners	2	2	2
	B1_Costs of internal processes and labour	3	1	3

	costs			
	B4_Marketing costs	4	4	4
Factor Tier **C_ Impact on Business Partner Relationships**	C2_Interactive service quality with meeting/event planners	1	1	1
	C1_Interactive service quality with meeting/event service suppliers	2	2	2
Factor Tier **D_ Impact on Customer Satisfaction**	D3_Satisfaction of meeting/event planners	1	1	1
	D2_Interactive service quality with meeting/event guests	2	1	2
	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up	3	3	3
Factor Tier **E_ Compatibility**	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems	1	2	1
	E2_RDS products and services are compatible with the existing distribution channels	2	1	2
	E1_RDS products and services are compatible with the event venues' current selling processes	3	3	3
Factor Tier **F_ Observability and Trialability**	G1_Observability	1	2	1
	H1_Trialability	2	1	2
Factor Tier **G_ Technology Competence**	I1_ICT Infrastructure	1	2	2
	I2_ICT Skills	2	1	1
	I3_Skill Development	3	3	3
Factor Tier **H_ Organisational Context**	J3_Organisational Scope	1	1	1
	J2_Financial	2	2	2

	Commitment			
Factor Tier **I_ External Environmental Context**	K1_Perceived Competitive Pressure	1	1	1
	K2_Perceived Stakeholder and Social Pressure	2	1	1

Chapter 5 – Analysis: Analytic Hierarchy Process Results

Chapter 5 – Analysis: Analytic Hierarchy Process Results

5.1 Introduction

This chapter provides the findings from the Analytic Hierarchy Process (AHP) mass survey which was conducted between October and November 2012. The aim of this AHP mass survey was to revalidate the priorities and weightings of the dimensions/criteria for monitoring the post-adoption economic value and effectiveness of RDS which were identified by the Delphi Panel experts according to the views of the venue operators in the US chain hotel systems. AHP is a mathematical method which assists group decision-making. As a result of the homogeneity of judgments and the aggregation of choices via the calculation of a geometric mean, the individual views of the group members could be aggregated into a single view (von Solms 2009).

The MeetingMatrix client base was used to conduct the mass survey research. MeetingMatrix RDS has been recognised as one of the latest and most accurate tools in the event industry for planning by the Professional Convention Management Association (PCMA) (TravelDailyNews 2007). Since 2005 the PCMA Space Verification has used MeetingMatrix RDS as its industry standard (Davis 2005). It was claimed that MeetingMatrix, which was founded in 1988, held approximately 80 per cent of the captured market share in both software and diagramming solutions for the global meeting industry (Business Wire 2005). The company has provided the researcher with access to the MeetingMatrix Customer Resources Management (CRM) system. A support team which included the Vice President of Operations, the Director of Customer Relations, the Director of Marketing and the Director of Sales in MeetingMatrix was assembled to facilitate the assistance to the research. The samples used in this research were from the CRM system and were selected according to stated criteria.

Through the relevant literature review as discussed in Chapter Two, considering the possible effects of heterophily of innovation diffusion across countries and the limitations of time and resources, this project decided to focus on the venues within

chain hotels in the USA. Therefore, three criteria have been set which prepare for the sample selection process at this stage in the project: the sample venues used are located in the USA; the sample venues used belong to the hotel sector; the sample hotels used are run within chain systems. It is also found that chain hotels are the major clients of RDS suppliers (MeetingMatrix 2012; Newmarket 2013).

5.2 Pilot Test

5,220 email contacts were generated from MeetingMatrix Customer Resources Management (CRM) system according to the three set criteria: the sample venues used are located in the USA; the sample venues used belong to the hotel sector; the sample hotels used are run within chain systems.

Two hundred email addresses were randomly selected from the 5,220 email database to conduct a pilot test on 20th October 2012. It was reported from email systems that 103 of the 200 email addresses were invalid. Although a following reminder message with survey link was sent to the potential respondents on 24th October, no respondent replied to the pilot study. It is suggested that a large reward, for example in the form of a sweepstakes prize, is more likely to increase the response rate than the certainty of a small incentive provided in the online research (Watt 1999). Therefore, considering the limitation of resources in this research, a raffle for an iPad mini was added as an incentive in order to encourage responses. Two additional reminder messages were transmitted electronically on 28th October and 31st October 2012 with the notification of the raffle for an iPad mini provided. This technique resulted in three respondents effectively replying to the pilot study. No specific issue in terms of the design and structure of the AHP questionnaire was raised from the pilot study results. Therefore, with some minor amendments the actual AHP mass survey was ready to commerce.

5.3 AHP Mass Survey

The actual AHP mass survey (Appendix 11) was conducted during 9th to 21st November to 2012. It was reported from email systems that 2,002 of the 5,020 email addresses which were generated from MeetingMatrix CRM system according to the

three set criteria were invalid. Some contacts replied that they did not feel qualified to answer the survey or no longer worked for the venues. Two reminder messages were transmitted electronically during the survey period in order to encourage responses. However, on 21st November MeetingMatrix, the study sponsor, had to ask the researcher to stop sending further reminder messages to its clients due to complaints/concerns from several corporate clients and requested that the researcher discontinue the survey so as not to further interfere with and/or disrupt the operations of their clients. As a result, fifty-five contacts replied to the AHP mass survey, and seven of the fifty-five were identified as ineffective responses (filling out the same number throughout the whole survey).

The low response rate (1.6%, 48 out of 3,008) experienced in this research may limit its ability to make generalised conclusions based on the research findings. Because of the complexity of the AHP technique, convenience sampling is usually used in relevant research designs such as Crouch's research of identification of destination competitiveness (Crouch 2011). Furthermore, due to the limited research resources in this project, this study could not target the population of every RDS venue manager in the US chain hotels who have used RDS but merely MeetingMatrix users and contacts from the company's database, the targeted venue managers. Therefore, the research results have to been viewed and examined as the results from non-probability sampling (Bryman and Bell 2011; Kitchenham and Pfleeger 2002). It has been reported that any non-random sampling approach used in quantitative research has the limitation of generalization in the aspect of statistics, even including studies which have high response rates (Ip et al. 2012). Bryman and Bell (2011) argue that the response rate is less of an issue for the studies using non-probability sampling. It is suggested that response rate may not the best way to judge the quality of survey results but representativeness of respondents is more important (Schouten et al. 2009). In this research several questions which referred to previous literature (Horan 2010; Jones and Baloglu 2006; Karadag et al. 2009; Singh and Kasavana 2005; Zhu et al. 2006) were designed to examine if any evidence exists to suggest that the survey results are unrepresentative of the populations the researcher was trying to

study. The representativeness of the effective respondents in this research can be examined in the Demographic information of the AHP mass survey respondents.

5.3.1 Demographic Information of the AHP Mass Survey Respondents

29.2% of respondents regard themselves responsible for the investment decision of Room Diagramming Solutions (RDS); 75% of respondents also consider themselves to be users of RDS.

Table 22 – Work Responsibilities with regard to RDS (Select All Applied)

	Percentages
User	75.0%
Duties as Part of My Job	31.3%
Investment Decision Maker	29.2%
Other: IT; Website Maintenance; Advisor	10.4%

Almost 80% of the respondents have more than 10 years experience in meeting and event businesses. 58.3% of the respondents describe their jobs as belonging to meetings, events, banquet and catering; 20.8% to sales and marketing; 18.8% to information technology; 2.1% to Quality and Efficiency.

Table 23 – Experience in Meeting and Event Businesses

	Respondents	**Cumulative Percentages**
More than 20 years	17	35.42%
11-20 years	20	77.08%
6-10 years	7	91.67%
1-5 years	4	100.00%

The work locations of the effective 48 respondents are well spread around the United States. However, the number of respondents working on the east coast is greater than the number on the west coast. Some cities have more than one respondent (for example, San Francisco, Boston and Dallas each have 3 respondents).

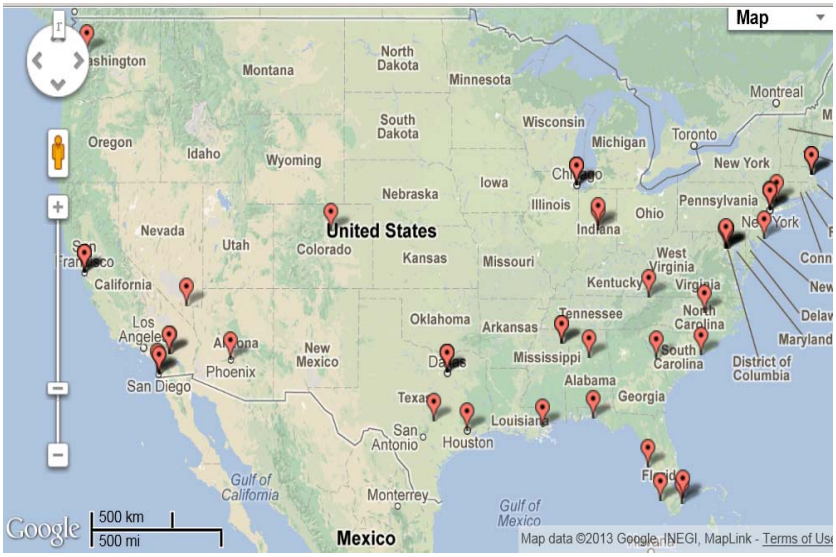

Figure 10 – Work Locations of the AHP Mass Survey Respondents

The age group 40-49 dominates the profiles of the respondents. The number of male respondents (31) is almost twice that of females (16).

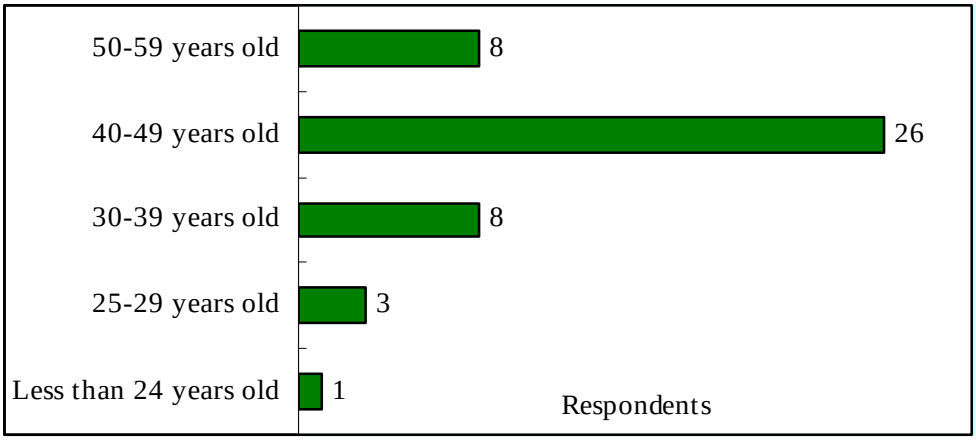

Figure 11 – The Age Groups of the AHP Mass Survey Respondents

To the author's best knowledge, there are no published academic articles that focus on the economic value and effectiveness of Room Diagramming Solutions to venue operators. The present empirical results have a more sophisticated weighting method which numerically evaluates venue managers' perception on the economic value and effectiveness of Room Diagramming Solutions using AHP. The effective responses

from the 48 experienced venue managers, therefore, are invaluable for the future research in the field of meeting and event technology management. The findings could provide a springboard for further research (Bryman and Bell 2011).

5.3.2 AHP Aggregation Calculation

It is suggested that an aggregate measure of the pairwise comparisons of all participating individuals could be obtained by means of calculation of the geometric mean of the individual judgments (Chen 2006; Saaty 2000). The software of Microsoft Excel was used to calculate the geometric means in this research.

5.3.3 Consistency Tests of AHP Mass Survey

The Consistency index (CI) and consistency ratio (CR) of each matrix were then calculated and given in Table 24 respectively in the assistance of the software of Expert Choice version 11.5.1815. All CI and CR values in Table 24 are lower or equal to 0.10 except for Set Goal (CR=0.12) and Factor Tier G_Technology Competence (CI= 0.11; CR=0.19). The sensitivity tests for Set Goal and Factor Tier G_Technology Competence were conducted as suggested by previous literature (Shih and Gong 2010) in order to improve the CI and CR as seen in Table 25. It is found by eliminating values from a specific survey (Unique Response Number: 10145990) in Set Goal, the adjusted CR can be improved to the suggested tolerable level (CI=0.05; CR=0.09). By eliminating values from three specific surveys (Unique Response Numbers: 10144061, 10145990 and 10192672) in Factor Tier G_Technology Competence, the adjusted CI and CR can be improved (CI=0.06; CR=0.10). The adjusted weightings of the categories, factor tiers and KPIs are given in Figure 12 and Table 26 respectively.

Table 24 – Consistency Tests for the AHP Mass Survey

Level	CI	Consistency Test	CR	Consistency Test
Set Goal	0.07	Accepted	0.12	Rejected
Category One: RDS Value	0.08	Accepted	0.09	Accepted
Factor Tier A_Impact on Sales	0.02	Accepted	0.03	Accepted
Factor Tier B_Impact on Efficiency	0.01	Accepted	0.01	Accepted
Factor Tier C_Impact on Business Partner Relationships	0	Accepted	-	-
Factor Tier D_Impact on Customer Satisfaction	0.05	Accepted	0.09	Accepted

Category Two: RDS Innovation Diffusion Characteristics	0	Accepted	-	-
Factor Tier E_Compatibility	0.05	Accepted	0.09	Accepted
Factor Tier F_Observability and Trialability	0	Accepted	-	-
Category Three: ICT Usage	0.05	Accepted	0.09	Accepted
Factor Tier G_Technology Competence	0.11	Rejected	0.19	Rejected
Factor Tier H_Organisational Context	0	Accepted	-	-
Factor Tier I_External Environmental Context	0	Accepted	-	-

CI= Consistency Index; CP= Consistency Ratio

Table 25 – CI Sensitivity Tests for Set Goal and Factor Tier G

Unique Response Number	Set Goal	Factor Tier G
10144005	0.06	0.10
10144061	0.06	0.08885
10145103	0.06	0.10
10145573	0.08	0.12
10145593	0.07	0.11
10145646	0.06	0.10
10145864	0.07	0.11
10145894	0.06	0.10
10145940	0.06	0.10
10145952	0.07	0.10
10145989	0.06	0.10
10145990	0.05	0.08961
10146029	0.08	0.13
10146149	0.07	0.12
10146323	0.06	0.11
10146865	0.06	0.10
10147277	0.06	0.10
10151766	0.07	0.11
10158197	0.06	0.10
10158219	0.07	0.12
10158408	0.06	0.10
10159676	0.06	0.10
10160426	0.07	0.11
10161371	0.06	0.10
10162366	0.08	0.12
10163087	0.06	0.11
10167107	0.06	0.10
10177697	0.07	0.10
10190180	0.07	0.11
10190651	0.07	0.11
10190879	0.06	0.12
10191300	0.07	0.11
10191441	0.06	0.10
10191527	0.06	0.11
10192672	0.07	0.09
10200607	0.06	0.10
10219996	0.06	0.11

10230258	0.07	0.12
10230263	0.06	0.10
10230389	0.07	0.11
10230941	0.06	0.10
10231623	0.06	0.10
10231669	0.06	0.10
10240677	0.07	0.11
10276694	0.06	0.09398
10059543	0.06	0.13
10079555	0.08	0.10
10079858	0.06	0.11

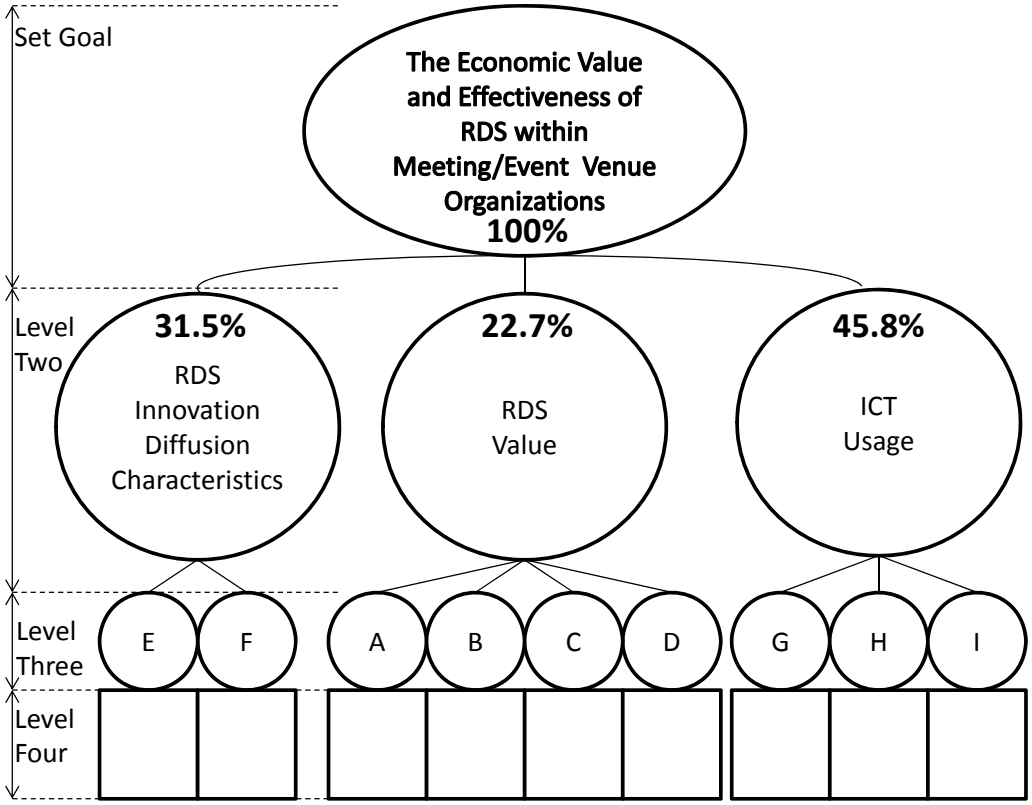

Figure 12 – The Adjusted Weighted Categories

Table 26 – The Adjusted Weighted Key Performance Indicators

Factor Tier	Weighting		Key Performance Indicator
	at Level Three	at Level Four	
Factor Tier **A_ Impact on Sales**	**2.5%**	**0.50%**	A1_Increased number of new clients
		1.30%	A2_Booking rate at the meeting/event venue
		0.70%	A4_Sales per labour hour
Factor Tier **B_ Impact on Efficiency**	**3.8%**	**0.60%**	B1_Costs of internal processes and labour costs
		1.00%	B2_Total labour working hours
		1.20%	B3_Costs of coordinating business partners
		1.00%	B4_Marketing costs
Factor Tier **C_ Impact on Business Partner Relationships**	**5.1%**	**1.50%**	C1_Interactive service quality with meeting/event service suppliers
		3.60%	C2_Interactive service quality with meeting/event planners
Factor Tier **D_ Impact on Customer Satisfaction**	**11.2%**	**2.30%**	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up
		3.00%	D2_Interactive service quality with meeting/event guests
		5.90%	D3_Satisfaction of meeting/event planners
Factor Tier **E_ Compatibility**	**12.9%**	**2.80%**	E1_RDS products and services are compatible with the event venues' current selling processes
		4.10%	E2_RDS products and services are compatible with the existing distribution channels
		6.00%	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems
Factor Tier **F_ Observability and Trialability**	**18.5%**	**11.20%**	F1_Trialability
		7.30%	F2_Observability
Factor Tier **G_ Technology Competence**	**11.0%**	**1.80%**	G1_ICT Infrastructure
		3.10%	G2_ICT Skills
		6.10%	G3_Skill Development
Factor Tier **H_ Organisational Context**	**14.8%**	**5.60%**	H1_Financial Commitment
		9.20%	H2_Organisational Scope

Factor Tier **I_ External Environmental Context**	**20.0%**	**6.60%**	I1_Perceived Competitive Pressure
		13.40%	I2_Perceived Stakeholder and Social Pressure

To summarise, in this phase of the research, a mass survey of all the US-based customers within the chain hotel systems from the MeetingMatrix Customer Relationship Management database, 48 ICT investment decision makers, meeting and event managers or hotel sales managers provided their views on the important levels of priorities and weightings of the 24 Key Performance Indicators (KPIs). A pairwise-comparison technique (Analytic Hierarchy Process, AHP) was used in the survey to prioritize and to give weightings to each KPI, each Factor Tier and each category.

These KPIs have the potential to be used in the evaluation and monitoring of the continuous and sustainable economic value and effectiveness of Room Diagramming Solutions (the set Goal). For example, as seen in Figure 12 and Table 26, the AHP technique helps to synthesise a group consensus that 45.8% of the hierarchical index system should be composed of the indicators which explain RDS-related ICT usage in the adopting hotels (at Level Two). Moreover, under the RDS-related ICT usage category, the group indicators on "Factor Tier I_external environmental context: the external arena in which a hotel conducts its business" at Level Three (sub-category, the Factor Tier) should account for 20% of the set Goal. The indicator "I2_perceived stakeholder and social pressure: the extent to which downstream customers (meeting/event planners) expect ICT room diagramming solutions to be used and have eBusiness systems ready to support the services" at Level Four should account for 13.4% of the set Goal.

As demonstrated in the Figure 12 and Table 26, the findings from this RDS research are similar in some aspects to the perspectives which have been discovered in the hospitality industry such as the high rankings of importance of ICT impact on customer satisfaction and business partner relationships for eBusiness adopting hospitality organisations in value creation processes (Fuchs et al. 2010). Cost

reduction and direct sales improvement were not considered as the most important indicators for monitoring the post-adoption performance of RDS in venue management. This is similar to the findings of the study conducted by Fuchs et al. (2009) for eBusiness adoption in Austrian hotels. Furthermore, among the 24 validated Key Performance Indicators (KPIs) within the framework for monitoring the economic value and effectiveness of RDS, the indicator "I2_perceived stakeholder and social pressure: the extent to which downstream customers (meeting/event planners) expect ICT room diagramming solutions to be used and have eBusiness systems ready to support the services" was rated as the most important indicator and accounted for 13.4% of the set Goal. ICT applications such as RDS may help event organisers and service providers to "fulfil their primary goal to produce a meeting that meets a client organisation's goals" and enable the client to better understand the value that the organisers and service providers add to events (Lee et al. 2013 p. 8). Combining these results, it may be concluded that in the hospitality industry customer and business partner satisfaction are crucial in term of the created economic value of ICT applications to property management organisations no matter before or after ICT adoption. RDS is similar to other eBusiness applications in the hospitality industry from this perspective. Furthermore, the 48 experts gave the factor tier of external environmental context, which comes from the TOE framework theory, the highest weighting among the nine factor tiers and accounting for 20% of the set Goal. This result strengthens the claim made by the critical mass theory which believes that when the total number of adopters for a specific innovation increases, then its value to users also increases (Lee et al. 2013).

Chapter 6 – Comparisons of Delphi and AHP Results

Chapter 6 – Comparisons of Delphi and AHP Results

6.1 Introduction

This research is intended to develop a framework to help event venue managers to monitor the economic sustainable efficiency of their Room Diagramming Solutions. The aim of this research is to incorporate a comprehensive set of dimensions and criteria to develop a flexible and practical indicator system for the evaluation of the economic value and effectiveness of RDS. Through the literature review, the consultation with a Delphi panel and an AHP mass survey, this aim has been successfully achieved.

During the whole process, the finalised criteria within the developed indicator system have been rated and ranked three times (Modified Delphi Round Two; Modified Delphi Round Three; AHP Mass Survey) by different techniques (Likert Scale; AHP Technique) through two groups (Expert Panel; Industrial Practitioners). Additional findings from the comparisons of the rankings of the criteria, factor tiers and categories have been generated by the following analyses.

6.2 Comparisons of the Modified Delphi Rounds

In this research project, the first round of the modified Delphi study aimed to consult and to validate the definitions of the Key Performance Indicators within the framework for the evaluation of RDS. From the second round of the modified Delphi results, the definition of each KPI had been finalised; therefore, the ranking of these KPIs were generated by the expert panel and could be compared between rounds. In the second round of the Delphi study, the Likert Scale was used, and there was no requirement for the panellists to compare the rankings among the categories and the factor tiers within the hierarchical structure of the evaluation framework. However, the KPIs within each factor tier had been allocated and presented in the same section of the survey. The panellists were asked to evaluate to what extent they felt each KPI was relevant within each section. Therefore, the rankings among the KPIs within the same section between rounds can be analysed.

In addition, in the third round of the modified Delphi, the implementation of the AHP technique had enabled not only the weightings on each KPI but also the ranking of these KPIs within each factor tier to be generated. Table 27 demonstrates the ranking comparison of the KPIs within each factor tier between the round two and the round three of the Delphi research.

Table 27 – Ranking Comparisons of KPIs among Delphi Round Three and Two within Factor Tiers

Factor Tier	**KPIs**	**Delphi Round Three (AHP Pairwise Comparison)**	**Delphi Round Two (Likert Scale) Importance Rating**
		N=6	**N=6 (also responded in AHP)**
Factor Tier **A_ Impact on Sales**	A1_Increased number of new clients	1	3
	A2_Booking rate at the meeting/event venue	2	1
	A4_Sales per labour hour	3	1
Factor Tier **B_ Impact on Efficiency**	B2_Total labour working hours	1	2
	B3_Costs of coordinating business partners	2	2
	B1_Costs of internal processes and labour costs	3	1
	B4_Marketing costs	4	4
Factor Tier **C_ Impact on Business Partner Relationships**	C2_Interactive service quality with meeting/event planners	1	1
	C1_Interactive service quality with meeting/event service suppliers	2	2
Factor Tier **D_ Impact on Customer Satisfaction**	D3_Satisfaction of meeting/event planners	1	1
	D2_Interactive service quality with meeting/event guests	2	1
	D1_Satisfaction level of meeting/event guests directly attributable to functionality of	3	3

	meeting/event room's set up		
Factor Tier **E_ Compatibility**	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems	1	2
	E2_RDS products and services are compatible with the existing distribution channels	2	1
	E1_RDS products and services are compatible with the event venues' current selling processes	3	3
Factor Tier **F_ Observability and Trialability**	G1_Observability	1	2
	H1_Trialability	2	1
Factor Tier **G_ Technology Competence**	I1_ICT Infrastructure	1	2
	I2_ICT Skills	2	1
	I3_Skill Development	3	3
Factor Tier **H_ Organisational Context**	J3_Organisational Scope	1	1
	J2_Financial Commitment	2	2
Factor Tier **I_ External Environmental Context**	K1_Perceived Competitive Pressure	1	1
	K2_Perceived Stakeholder and Social Pressure	2	1

It can be found that in the factor tier of Factor Tier B_ Impact on Efficiency, though different priority techniques were used in the two rounds, the KPI of "B4_Marketing costs" was ranked as the least important compared to the other three indicators. This result is similar to the findings of the research conducted by Fuchs et al. (2010) on eBusiness impact and adoption among Austrian Destination Management Organisations. However, it must be noticed that in the research conducted by Fuchs et al., eBusiness applications included DMS, CRM, ERP, WEB and so on but not RDS. Therefore, (1) the different functionality among eBusiness applications which were focused on and (2) the varied methodologies which were used to address

research questions and inquiries may limit the comparability of the results of the two pieces of the research.

In the factor tier of Factor Tier E_Compatibility, the KPI of “E1_RDS products and services are compatible with the event venues' current selling processes” was ranked as the least important compared to the other three indicators. In the factor tier of Factor Tier G_Technology Competence, “I3_Skill Development” was ranked as the least important compared to the other three indicators. The findings strengthen the claim made by a relevant research paper which explored the behavioural aspects of adopting technology in the meeting and event industry; Lee et al. (2013) found that meeting and event professionals feel that they may not be able to avoid using a technology which is widely used within their group no matter how complex it is because they would like to fit in with the group. Furthermore, it is found that some experts in the Delphi study claim that RDS software is “reasonably intuitive” (Unique Response Number: 8321917); therefore, user training and skill development are not regarded as very important factors when pursuing an effective use of RDS. This result seems to contradict the hypothesis of Jones and Baloglu (2006). In their research it is found that there is a gap between the importance of RDS and the added value that sales personnel perceive the tools bring in terms of their daily sales responsibilities; their research, therefore, considers that insufficient follow-up training could be one of the reasons causing this gap.

In addition, there is consistency existing in the priorities of KPIs in Factor Tier C_Impact on Business Partner Relationships, Factor Tier D_Impact on Customer Satisfaction and Factor Tier H_Organisational Context. From the perspective of the ontological presumptions which this research set, these results may imply that there seems to an external reality existing to the expert panel that the KPIs of “C2”, “D3” and “J3” have high priorities over the other KPIs where they are allocated within this evaluation framework. In addition, the high rankings and weightings of importance of ICT impact on customer satisfaction (the indicators of D2 and D3) and business partner relationships (the indicator of C2) in the category of ICT value are similar to the research results of Fuchs et al. (2010) on eBusiness adopting hospitality

organisations in value creation processes. However, as mentioned, the comparability of these research results to the other similar research papers such as Fuchs et al. (2010) and Zhu et al. (2006) is limited. It can be found that not only are the components of the factor tier and the definitions of the KPIs varied due to the functionality of the different eBusiness applications focused on, but the different research concerns and methodologies used in these papers are also varied. For example, in the research conducted by Fuchs et al. the research concerns are not the rankings and the priorities of the KPIs but the internal influences among factor tiers and KPIs through the use of the linear structural equation modelling approach.

6.3 Comparisons of Two AHP Surveys

In the third round of the modified Delphi research and the AHP mass survey, both the expert panellists and the practitioners were asked to use the AHP technique to give weightings to each KPI. By analysing the opinions of two different groups of experts and practitioners, Table 28 demonstrates the weighting comparisons.

Table 28 – The AHP Weighting Comparisons

Factor Tier	**Weighting**		**Key Performance Indicator**
	Delphi Round Three (AHP)	**AHP Mass Survey**	
Factor Tier **A_ Impact on Sales**	**4.6%**	**0.5%**	A1_Increased number of new clients
	4.2%	**1.3%**	A2_Booking rate at the meeting/event venue
	3.9%	**0.7%**	A3_Sales per labour hour
Factor Tier **B_ Impact on Efficiency**	**2.4%**	**0.6%**	B1_Costs of internal processes and labour costs
	4.6%	**1.0%**	B2_Total labour working hours
	3.7%	**1.2%**	B3_Costs of coordinating business partners
	1.6%	**1.0%**	B4_Marketing costs
Factor Tier **C_ Impact on Business Partner Relationships**	**1.5%**	**1.5%**	C1_Interactive service quality with meeting/event service suppliers
	6.1%	**3.6%**	C2_Interactive service quality with meeting/event planners
Factor Tier **D_ Impact on Customer**	**3.5%**	**2.3%**	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up

Satisfaction	**7.8%**	**3.0%**	D2_Interactive service quality with meeting/event guests
	11.2%	**5.9%**	D3_Satisfaction of meeting/event planners
Factor Tier **E_ Compatibility**	**2.7%**	**2.8%**	E1_RDS products and services are compatible with the event venues' current selling processes
	4.3%	**4.1%**	E2_RDS products and services are compatible with the existing distribution channels
	4.8%	**6.0%**	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems
Factor Tier **F_ Observability and Trialability**	**4.2%**	**11.2%**	F1_Trialability
	6.4%	**7.3%**	F2_Observability
Factor Tier **G_ Technology Competence**	**4.6%**	**1.8%**	G1_ICT Infrastructure
	4.2%	**3.1%**	G2_ICT Skills
	3.1%	**6.1%**	G3_Skill Development
Factor Tier **H_ Organisational Context**	**2.2%**	**5.6%**	H1_Financial Commitment
	4.7%	**9.2%**	H2_Organisational Scope
Factor Tier **I_ External Environmental Context**	**2.3%**	**6.6%**	I1_Perceived Competitive Pressure
	1.3%	**13.4%**	I2_Perceived Stakeholder and Social Pressure

It can be found that except for some KPIs such as the indicator of "C1_Interactive service quality with meeting/event service suppliers", most of the KPIs were weighted quite differently between the Delphi round three and the AHP mass survey. The difference partially attributes to the weightings given on the parent factor tiers and categories of these KPIs. The weightings of each KPI were calculated by the multiplication of the weightings given to the parent category, the parent factor tiers and the weighting given to KPI itself. The weighting comparisons of the categories and the factor tiers can be reviewed in Table 29 and Table 30.

Table 29 – Comparisons of Weightings in Factor Tiers

Category	**Factor Tier**	**AHP Survey**	**Delphi Round Three (AHP)**
		N=48	**N=6**
		Weighting	
RDS Value	Factor Tier A_ Impact on Sales	2.5%	12.7%

	Factor Tier B_ Impact on Efficiency	3.8%	12.3%
	Factor Tier C_ Impact on Business Partner Relationships	5.1%	7.6%
	Tier D_ Impact on Customer Satisfaction	11.2%	22.5%
RDS Innovation Diffusion Characteristics	Factor Tier E_ Compatibility: the degree to which an innovation is consistent with existing business processes, practice and value systems	12.9%	11.8%
	Factor Tier F_ Observability and Trialability: the degree to which the results of an innovation are visible to others; the degree to which an innovation may be experimented with	18.5%	10.6%
ICT Usage	Factor Tier G_ Technology Competence: the existing technologies in use and relevant technical skills available in the organisation	11.0%	11.9%
	Factor Tier H_ Organisational Context: internal measures of the organisation	14.8%	6.9%
	Factor Tier I_ External Environmental Context: the external arena in which a company conducts its business	20.0%	3.6%

Table 30 – Comparisons of Weightings in Categories

Category	**AHP Survey Importance Rating**	**Delphi Round Three (AHP) Importance Rating**
	N=48	**N=6**
	Weighting	
ICT Usage	45.8%	22.5%

RDS Innovation Diffusion Characteristics	31.5%	22.4%
RDS Value	22.7%	55.1%

It can be found that the category of ICT Usage was ranked by the practitioners as the most important category when evaluating RDS effectiveness. However, RDS value was regarded as the most important category by the expert panellists. In order to eliminate the multiplication effect from the parent categories and factor tiers, Table 31 compares only the rankings of each KPI within the same factor tiers.

Table 31 – Comparisons of Priorities in KPIs

Factor Tier	**KPIs**	**Importance Ranking**	
		M	**R3**
		N=48	**N=6**
Factor Tier **A_ Impact on Sales**	A2_Booking rate at the meeting/event venue	1	2
	A3_Sales per labour hour	2	3
	A1_Increased number of new clients	3	1
Factor Tier **B_ Impact on Efficiency**	B3_Costs of coordinating business partners	1	2
	B4_Marketing costs	2	4
	B2_Total labour working hours for making meeting and event spaces set up ready	3	1
	B1_Costs of internal processes and labour costs	4	3
Factor Tier **C_ Impact on Business Partner Relationships**	C2_Interactive service quality with meeting/event planners	1	1
	C1_Interactive service quality with meeting/event service suppliers	2	2
Factor Tier **D_ Impact on Customer Satisfaction**	D3_Satisfaction of meeting/event planners	1	1
	D2_Interactive service quality with meeting/event guests	2	2
	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up	3	3
Factor Tier **E_ Compatibility**	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems	1	1

	E2_RDS products and services are compatible with the existing distribution channels	2	2
	E1_RDS products and services are compatible with the meeting/event venues' current selling processes	3	3
Factor Tier **F_ Observability and Trialability**	F1_Trialability	1	2
	F2_Observability	2	1
Factor Tier **G_ Technology Competence**	G3_Skill Development	1	3
	G2_ICT Skills	2	2
	G1_ICT Infrastructure	3	1
Factor Tier **H_ Organisational Context**	H2_Organisational Scope	1	1
	H1_Financial Commitment	2	2
Factor Tier **I_ External Environmental Context**	I2_Perceived Stakeholder and Social Pressure	1	2
	I1_Perceived Competitive Pressure	2	1

M=AHP Mass Survey
R3=Delphi Round Three (AHP Pairwise Comparison)

By eliminating the multiplication effect from the parent factor tiers and categories it can be found that though different groups of people were consulted in the final round of the Delphi study and the AHP mass survey, there is consistency existing in the priorities of KPIs in “Factor Tier C_Impact on Business Partner Relationships”, “Factor Tier D_ Impact on Customer Satisfaction”, Factor Tier E_Compatibility” and “Factor Tier H_Organisational Context”. The members of the expert panel and the industrial practitioners all reach a consensus that the KPIs of “C2_Interactive service quality with meeting/event planners”, “D3_Satisfaction of meeting/event planners”, “E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems” and “H2_Organisational Scope” are the most important criteria within the factor tiers where they are allocated in the evaluation framework.

In addition, comparing with the results from the AHP mass survey and the Delphi round three AHP, it can be found that Factor Tier D_Impact on Customer Satisfaction was perceived by both the expert panel and by targeted venue managers as the most important indicator cluster in the factor tier level of RDS value category as shown in Table 32. Cost reduction and direct sales improvement were not

considered as the most important indicators for monitoring the post-adoption performance of RDS in venue management. This is similar to the findings of the study conducted by Fuchs et al. (2009) for eBusiness adoption in Austrian hotels.

The high weightings of importance of ICT impact on customer satisfaction in the category of ICT value is similar to the research results of Fuchs et al. (2010) on eBusiness adopting hospitality organisations in value creation processes. Furthermore, many respondents in this research project provided their comments that they believe the most important expected and measurable economic value of RDS to their businesses is the improvement of relationships with meeting and event planners, their customers, rather than decreased costs or increased guest numbers.

Table 32 – Comparisons of Priorities in Factor Tiers

Category	**Factor Tier**	**AHP Survey**	**Delphi Round Three (AHP)**
		N=48	**N=6**
		Ranking	
RDS Value	Factor Tier D_ Impact on Customer Satisfaction	1	1
	Factor Tier C_ Impact on Business Partner Relationships	2	4
	Factor Tier B_ Impact on Efficiency	3	3
	Factor Tier A_ Impact on Sales	4	2
RDS Innovation Diffusion Characteristics	Factor Tier F_ Observability and Trialability: the degree to which the results of an innovation are visible to others; the degree to which an innovation may be experimented with	1	2
	Factor Tier E_ Compatibility: the degree to which an innovation is consistent with existing business processes, practice and value systems	2	1

ICT Usage	Factor Tier I_ External Environmental Context: the external arena in which a company conducts its business	1	3
	Factor Tier H_ Organisational Context: internal measures of the organisation	2	2
	Factor Tier G_ Technology Competence: the existing technologies in use and relevant technical skills available in the organisation	3	1

6.4 Summary

According to the set aim and objectives of this research, several philosophical presumptions are implied, and the nature and limitations of this research are also disclosed. This research took the position of the existence of an external economic reality that governed past, present and future economic outcomes: a single social reality (Davidson 1996). In this research the aim and major concerns are to establish a framework which could be used by venue managers to evaluate the economic value and effectiveness of a specific ICT innovation, RDS. The economic value and effectiveness are, therefore, regarded as external reality in the chosen ontological position. The managers could tend to the view that the economic goals which their organisations pursue are an external reality. The managers learn and apply the economic regulations and rules. Therefore, there exist some priorities of their economic goals and the accompanying KPIs to these goals.

It can be found that though different priority techniques were used and different groups of people were consulted, there is consistency existing in the priorities of KPIs in Factor Tiers C_Impact on Business Partner Relationships, D_Impact on Customer Satisfaction, Factor Tier E_Compatibility and H_Organisational Context as demonstrated in Table 33. From the comparisons of the results generated by different priority techniques and through two different groups of experts and industrial practitioners in this research, it can be found that there seems to some

priorities being identified and validated. For example, the members of the expert panel and the industrial practitioners all reach a consensus that the KPIs of "C2_Interactive service quality with meeting/event planners", "D3_Satisfaction of meeting/event planners", "E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems" and "H2_Organisational Scope" are the most important criteria in the factor tiers where they are allocated within the evaluation framework. It can also be found that Factor Tier D_Impact on Customer Satisfaction was perceived as the most important indicator cluster in the factor tier level of RDS value category. Table 33 triangulates the research findings of the Likert Scale of the Modified Delphi study, the AHP Technique of the Modified Delphi study and the AHP Mass Survey study. Therefore, from the perspective of the ontological presumptions which this research set, these results may imply that there seems to an external reality existing to the expert panel and industrial practitioners surveyed that the KPIs of "C2", "D3", "E3" and "H2" have high priorities over the other KPIs and that the "Factor Tier D" is the most important component in the RDS value category within the evaluation framework. This external reality is reflected from the consensus and judgement of the aggregated opinions and perceptions by diversified, independent and trained individuals through a mathematical mechanism.

Table 33 – Comparisons of Priorities in KPIs

Factor Tier	**KPIs**	**Importance Ranking**			
		M	**R3**	**R2A**	**R2**
		N=48	**N=6**	**N=6**	**N=11**
Factor Tier **A_ Impact on Sales**	A2_Booking rate at the meeting/event venue	1	2	1	1
	A3_Sales per labour hour	2	3	1	2
	A1_Increased number of new clients	3	1	3	3
Factor Tier **B_ Impact on Efficiency**	B3_Costs of coordinating business partners	1	2	2	2
	B4_Marketing costs	2	4	4	4
	B2_Total labour working hours for making meeting and event spaces set up ready	3	1	2	1
	B1_Costs of internal processes and labour costs	4	3	1	3

Factor Tier **C_ Impact on Business Partner Relationships**	C2_Interactive service quality with meeting/event planners	1	1	1	1
	C1_Interactive service quality with meeting/event service suppliers	2	2	2	2
Factor Tier **D_ Impact on Customer Satisfaction**	D3_Satisfaction of meeting/event planners	1	1	1	1
	D2_Interactive service quality with meeting/event guests	2	2	1	2
	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up	3	3	3	3
Factor Tier **E_ Compatibility**	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems	1	1	2	1
	E2_RDS products and services are compatible with the existing distribution channels	2	2	1	2
	E1_RDS products and services are compatible with the meeting/event venues' current selling processes	3	3	3	3
Factor Tier **F_ Observability and Trialability**	F1_Trialability	1	2	1	2
	F2_Observability	2	1	2	1
Factor Tier **G_ Technology Competence**	G3_Skill Development	1	3	3	3
	G2_ICT Skills	2	2	1	1
	G1_ICT Infrastructure	3	1	2	2
Factor Tier **H_ Organisational Context**	H2_Organisational Scope	1	1	1	1
	H1_Financial Commitment	2	2	2	2
Factor Tier **I_ External Environmental Context**	I2_Perceived Stakeholder and Social Pressure	1	2	1	1
	I1_Perceived Competitive Pressure	2	1	1	1

M=AHP Mass Survey
R3=Delphi Round Three (AHP Pairwise Comparison)
R2A=Delphi Round Two (Likert Scale Importance Rating; also responded in AHP)
R2=Delphi Round Two (Likert Scale Importance Rating)

Chapter 7 – Conclusions and Recommendations

Chapter 7 –Conclusions and Recommendations

7.1 Introduction

The thesis concludes with the recommendations and practical implications from this research and the directions for future research within this domain. When discussing the results and conclusions of a research project, it is useful to revisit the aim of the research. There is a gap in the assessment studies of the adoption of Internet RDS within both meeting and event and eTourism literature. To the author's best knowledge, only limited previous studies include RDS within their research on eBusiness applications, and there are no published academic articles that focus on the productivity and effectiveness of Room Diagramming Solutions to venue operators (Jones and Baloglu 2006; UNLV 2001). Thus, this research intended to develop a framework to help event venue managers to monitor the economic sustainable efficiency of their Room Diagramming Solutions. The aim of this research is to incorporate a comprehensive set of dimensions and criteria to develop a flexible and practical indicator system for the evaluation of the productivity and effectiveness of RDS. This aim has been successfully achieved according to the results of the research presented.

Firstly, through review of the relevant literature, this project identified similar studies carried out within the topic area and examined how the research has been carried out. The literature review of this project collected comprehensive materials and research concerning RDS and has contributed to the knowledge building from the perspective of analysing the historical development processes of RDS. To the author's best knowledge, the results are the most completed collection of literature concerning RDS to date. The literature review of this project then joined the debate of general ICT productivity in the academic community and suggested that a performance-based indicator system which could accommodate both tangible and intangible factors influencing ICT outcomes and which could be monitored constantly may be used to demonstrate long-term ICT value. Unlike previous research papers which concerned the adoption stage of ICT at organisational or individual level and used the Technology Acceptance Model (TAM) as the key basis for adoption or non-

adoption of decision making processes, this project is concerned with the post-adoption stage. Innovation diffusion theory, Technology-Organisation-Environment (TOE) framework and the eBusiness impact model were used as the key basis in this project as suggested by previous relevant literature (Fuchs et al. 2010; Zhu et al. 2006). These three fundamental theories suggest that in the post-adoption stage by systematically analysing the actual use and characteristics of ICT innovation in the adopting organisations, the value created by ICT could be realised through monitoring relevant Key Performance Indicators (KPIs). Fuchs et al. (2010) suggested that the integrated eBusiness indicator framework should be further tested and improved in other sectors of the tourism and hospitality industry. In addition, accompanied by the continuous development of ICT, rich functionality has continued to grow and added to a specific ICT innovation such as RDS. In order to track the very dynamic developments of RDS as discussed in the chapter of literature review in this thesis, in the adopting organisations tailored KPIs and a corresponding evaluation framework for RDS should be built from the perspective of venue managers and other key stakeholders (Chau and Tam 1997; Colecchia 1999; Zhu et al. 2006). Therefore, an expert panel was recruited and provided help to develop these tailored KPIs and an evaluation framework through a modified Delphi method.

7.2 Modified Delphi Phase Conclusions

Secondly, through a three-round modified Delphi study this research has presented the validated and prioritised hierarchical portfolio of evaluation factors for meeting and event venue operators' potential use in monitoring the productivity and effectiveness of RDS. The proposed KPIs in the modified Delphi study were adopted and adapted from previous relevant research of Innovation Diffusion Theory, the TOE framework and the eBusiness impact model as the key basis for the development of the KPIs descriptions for RDS. Rogers (2003) (for F3; F4; G1; H1), Zhu and Kraemer (2005) (for J2), Zhu et al. (2006) (for E1; E2; E3; F1; I1; I2; I3; K1; K2), Fuchs et al. (2009) (for F2; J1; J3) and Fuchs et al. (2010) (for A1; A2; A3; A4; B1; B2; B3; B4; C1; C2; D1; D2; D3) were adopted as the key bases for the development of the KPIs descriptions. Many comments received from the first round Delphi expert panel confirmed the need to develop tailor-made KPIs for the post-

adoption monitoring of RDS in venue management as recommended by previous literature (Chau and Tam 1997; Rogers 2003; Swanson 1994; Zhu et al. 2006). The adapted theory and models appear to be highly useful as the starting point of the development of an ICT application evaluation framework in the hospitality sector, which echoes Fuchs et al.'s research (2009). The development processes and methodology and methods used in this RDS research may be used for other specific ICT innovations. Table 34 demonstrates the development processes of the tailored KPIs within the evaluation framework.

Table 34 – Revised KPIs Based on Comments from the Modified Delphi First Round, Original KPIs and KPIs Used in Previous Literature

Revised KPIs	Original Proposed KPIs	KPIs Used in Previous Literature
A1_**Increased** number of new **clients (i.e. meeting/event planners who use the venue for the first time because of the availability of Internet room diagramming solutions)**	A1_Number of new guests through ICT application	Number of guests from new sending countries
A2_Booking rate at the meeting/event venue	A2_Booking rate at the meeting/event venue	Booking rate at the destination
A3_Regional market share **(i.e. within a city)**	A3_Regional market share	Regional market share
A4_Sales per labour hour	A4_Sales per labour hour	Labour productivity
B1_Costs of internal processes and **labour costs**	B1_Costs of internal processes	Costs of internal processes
B2_**Total labour working hours for making meeting and event spaces set up ready**	B2_Costs per labour hour	Labour productivity
B3_Costs of coordinating business partners **(i.e. meeting/event planners or decoration service suppliers)**	B3_Costs of coordinating business partners	Costs of coordinating business partners
B4_Marketing costs **(i.e. conducting marketing campaigns for the promotion of meeting/event room spaces)**	B4_Marketing costs	Marketing costs
C1_**Interactive service** quality with meeting/event service suppliers (e.g. catering or **decoration** service suppliers)	C1_Quality of relationship with meeting/event service suppliers (e.g. Catering service suppliers)	Quality of relationship to tourism service providers
C2_**Interactive service** quality with meeting/event planners (e.g. wedding or **exhibition** planners)	C2_Quality of relationship with meeting/event planners (e.g. Wedding planners)	Quality of relationship to tourism organisations
D1_Satisfaction **level** of meeting/event guests **directly attributable to functionality of meeting/event room's set up**	D1_Satisfaction of meeting/event guests	Satisfaction of tourists
D2_**Interactive service** quality with meeting/event guests **(e.g. with accessibility of meeting/event room's set up and utilization of space**)	D2_Quality of relationship with meeting/event guests	Quality of relationship to tourists
D3_Satisfaction of meeting/event planners	D3_Satisfaction of meeting/event planners	Satisfaction of tourism service providers
E1_RDS products and services are compatible with the meeting/event venues' current	E1_RDS products and services are compatible with the meeting/event	Selling over the Internet is compatible with your company's current selling process

selling processes **(i.e. catering program)**	venues' current selling processes	
E2_RDS products and services are compatible with the existing distribution channels **(i.e. the venues' websites)**	E2_RDS products and services are compatible with the existing distribution channels	Conducting transactions over the Internet is compatible with existing distribution channels
E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate culture and value systems	Doing eBusiness is compatible with your company's corporate culture and value system
F1_Cost of integrating RDS products and services to the venues' sales (including hardware, **measuring the rooms, creating scaled diagrams**, software, training, organisational restructuring and business process reengineering)	F1_Cost of integrating RDS products and services to the venues' sales (including hardware, software, training, organisational restructuring, business process reengineering)	Costs of implementing Internet-based online sales (including hardware, software, training, organisational restructuring, business process reengineering)
F2_Training hours to the operators in the meeting/event venues for the application of RDS products and services	F2_Training hours to the operators in the meeting/event venues for the application of RDS products and services	ICT training costs
F3_The degree to which RDS products and services are **complex** and difficult to use in the perceptions of meeting/event venue staff	F3_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event venue staff	The degree to which an innovation is difficult to use
F4_The degree to which RDS products and services are **complex** and difficult to use in the perceptions of meeting/event planners	F4_The degree to which RDS products and services are difficult to use in the perceptions of meeting/event planners	The degree to which an innovation is difficult to use
G1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues' **websites as visible and easy to find (i.e. how many transferring web pages needed from the venue's web front page to the page hosting RDS products and services)**	G1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to search for (e.g. In the websites of the venues)	The degree to which the results of an innovation are visible to others
H1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues' **websites as easy to experiment with and try (i.e. what waiting time is needed to install or log into**	H1_The degree to which the meeting/event planners perceive RDS products and services in the targeted venues difficult to experiment with (e.g. In the websites	The degree to which an innovation may be experimented with

the trial version of RDS products and services from the hosting downloadable page)	of the venues)	
I1_ICT Infrastructure: the strength of existing ICT infrastructure, as measured by related technologies that the meeting/event venue has in place, including electronic data interchange(EDI), intranet, extranet, local area network (LAN), wide area network (WAN)	I1_ICT Infrastructure: the strength of existing ICT infrastructure, as measured by related technologies that the meeting/event venue has in place, including electronic data interchange (EDI), intranet, extranet, local area network (LAN), wide area network (WAN)	IT infrastructure: the strength of existing IT infrastructure, as measured by related technologies that your company has in place, including electronic data interchange (EDI), intranet, extranet, local area network (LAN), wide area network (WAN)
I2_ICT Skills: the extent to which the majority of the employees in the meeting/event venue are capable of using the following applications - web browser, intranet, online Request for Proposal (RFP) processing and **the existence of in-house IT department or support**	I2_ICT Skills: the extent to which the majority of the employees in the meeting/event venue are capable of using the following applications - web browser, intranet, online Request for Proposal (RFP) processing	Internet skills: The extent to which the majority of your employees are capable of using the following applications - Web browser, intranet, online order processing
I3_Skill Development: the extent to which the meeting/event venue has implemented the following in order to help employees develop eBusiness skills such as (a) in-house training; (b) participation in ICT training such as courses and seminars run by third parties; (c) designating certain work time for ICT learning/training; (d) establishing self-learning or e-learning programs; (e) recruiting staff with special ICT skills	I3_Skill Development: the extent to which the meeting/event venue has implemented the following in order to help employees develop eBusiness skills such as (a) in-house training; (b) participation in ICT training such as courses and seminars run by third parties; (c) designating certain work time for ICT learning/training; (d) establishing self-learning or e-learning programs; (e) recruiting staff with special ICT skills	Skill development – Has your company done the following to help employees develop e-business skills: (a) in-house training? (b) participating in IT training such as courses and seminars by third parties? (c) legitimizing certain work time for IT learning/training? (d) establishing self-learning or e-learning programs? (e) recruiting staff with special IT skills?
J1_Organisation Size: number of employees in the meeting/event venue	J1_Organisation Size: number of employees in the meeting/event venue	Firm size: number of employees
J2_Financial Commitment: ICT operating, **software and space measurement budget**, as	J2_Financial Commitment: ICT operating budget, as	IS operating budget, as percentage of total revenue

percentage of total revenue	percentage of total revenue	
J3_Organisational **Scope: amount and size of diagramable spaces in the venue**	J3_Organisational Type: hotel star- 0/1/2/3/4/5	hotel star- 0/1/2/3/4/5
J4_International Scope: the extent of conducting business in international markets (i.e. the extent to which clients come from different countries)	-	
K1_Perceived Competitive Pressure: percentage of competitors in the city of the meeting/event venue that have adopted ICT room diagramming solutions **and the predicted ICT room diagramming solutions forthcoming investments of important competitors**	K1_Perceived Competitive Pressure: percentage of competitors in the city of the meeting/event venue that have adopted ICT room diagramming solutions	Percentage of competitors in your industry that have conducted Internet-based services
K2_Perceived Stakeholder and Social Pressure: the extent to which downstream customers (meeting/event planners) **expect ICT room diagramming solutions to be used** and have eBusiness systems ready to support the services	K2_Perceived Stakeholder Pressure: the extent to which downstream customers (meeting/event planners) have eBusiness systems ready to support ICT room diagramming solutions	The extent to which downstream customers have eBusiness systems ready to support Internet-based selling

From the results of this modified Delphi study as shown in Table 35, the indicator cluster of complexity (Factor Tier F_Complexity: the degree to which an innovation is difficult to use) was rated as the least important, suggesting that the costs of integrating RDS products and services to the venues, the training hours for RDS and the skill difficulty faced when using RDS may not be the major concerns for venue management in the post-adoption monitoring. The findings strengthen the claim made by a relevant research paper which explored the behavioural aspects of adopting technology in the meeting and event industry; Lee et al. (2013) found that meeting and event professionals feel that they may not be able to avoid using a technology which is widely used within their group no matter how complex it is because they would like to fit in with the group. In addition, the findings from the first two rounds of the modified Delphi study confirm with the findings from previous literature, where RDS was regarded as an important communication platform for business partners (Bowdin et al. 2010; Silvers 2012). The expert panel regarded that the framework which will be used to monitor the post-adoption economic value and effectiveness of RDS should highlight the indicators involving the evaluations of quality with and satisfaction of these business partners (Factor Tier C_Impact on Business Partner Relationships).

Table 35 – A Comparison of Second and First Round Delphi Survey Results

Key Performance Indicator	**Round Two**				**Round One**			
	Importance Rating				**Importance Rating**			
	N= 11 (Delphi Panel Size)				**N= 18 (Delphi Panel Size)**			
	Mean	*SD*	*CP*	*Ranking*	*Mean*	*SD*	*CP*	*Ranking*
C2_Interactive service quality with event planners	4.73	0.47	100.00%	1	4.44	0.71	88.90%	2
I2_ICT Skills	4.18	0.41	100.00%	1	3.89	0.96	72.20%	7
C1_Interactive service quality with event service suppliers	4.36	0.67	91.00%	3	4.44	0.71	88.90%	2
D3_Satisfaction of meeting/event planners	4.64	0.67	90.90%	4	4.67	0.59	94.40%	1
D2_Interactive service quality with event guests	4.18	0.75	81.90%	5	3.78	0.94	55.60%	16

B3_Costs of coordinating business partners	4	0.89	81.80%	6	3.44	1.1	66.70%	10
E1_RDS products and services are compatible with the event venues' current selling processes	3.91	0.54	81.80%	6	4.11	1.02	77.70%	5
B1_Costs of internal processes and labour costs	4	1	72.80%	8	3.72	1.27	61.10%	15
E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems	4	1	72.80%	8	4.11	0.76	77.70%	5
I1_ICT Infrastructure	4	0.78	72.80%	8	3.83	0.92	72.20%	7
B2_Total labour working hours	4.18	1.08	72.70%	11	3.89	1.41	66.70%	10
J3_Organisational Scope: amount and size of diagramable spaces in the venue	3.73	0.79	72.70%	11	3.56	1.2	50.00%	18
A2_Booking rate at the meeting/event venue	3.91	0.7	72.20%	13	3.89	1.23	72.20%	7
D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up	4	0.89	63.70%	14	4	0.97	66.70%	10
E2_RDS products and services are compatible with the existing distribution channels	4	0.89	63.70%	14	3.78	0.81	66.70%	10
A4_Sales per labour hour	3.73	0.91	63.70%	14	3.33	1.24	50.00%	18
I3_Skill	3.73	1.1	63.70%	14	4.11	0.68	83.40%	4

Development								
K2_Perceived Stakeholder and Social Pressure	3.55	0.69	63.60%	18	3.33	1.09	50.00%	18
H1_Trialability	3.36	0.92	63.60%	18	3.61	0.98	50.00%	18
B4_Marketing costs	3.55	1.04	54.60%	19	3.44	0.92	44.40%	26
G1_Observability	3.55	1.04	54.60%	19	3.39	1.15	38.90%	28
K1_Perceived Competitive Pressure	3.55	1.04	54.60%	19	3.33	1.24	50.00%	18
A1_Increased number of new clients	3.45	1.21	54.60%	19	3.5	1.1	55.60%	16
J2_Financial Commitment	3.36	0.81	54.50%	24	3.78	1.06	66.70%	10
J1_Organisation Size	3.45	0.82	45.50%	25	3.33	1.19	38.90%	28
F3_The degree to which RDS products and services are complex and difficult to use in the perceptions of meeting/event venue staff	3.09	1.14	45.50%	25	3.44	1.1	38.90%	28
A3_Regional market share	3.36	0.51	36.40%	27	3.33	0.97	50.00%	18
J4_International Scope	3.36	1.03	36.40%	27	-	-	-	-
F1_Cost of integrating RDS products and services to the venues' sales	3.18	0.98	36.40%	27	3.72	0.96	50.00%	18
F2_Training hours to the operators in the meeting/event venues for the application of RDS products and services	3.18	1.17	36.40%	27	3.56	1.2	44.40%	26
F4_The degree to which RDS products and services are complex and difficult to use in the perceptions of meeting/event	2.82	1.47	27.30%	31	3.39	1.29	50.00%	18

planners								

SD=Standard Deviation; CP= Cumulative Percentage

Moreover, as demonstrated in the Figure 13 and the Table 36, in the category of Innovation Diffusion Characteristics, the indicator cluster of compatibility was rated by the expert panel as the most important factor tier when monitoring the post-adoption performance of RDS in venue management. In the category of TOE framework the factor tier of technology competence was rated higher than others. These results are similar to the findings of previous post-adoption eBusiness literature (Zhu and Kraemer 2005; Zhu et al. 2006). For example, in the research results of Zhu et al. (2006) compatibility and technology competence are the most important readiness among all tested innovation characteristics and the TOE factors in their model.

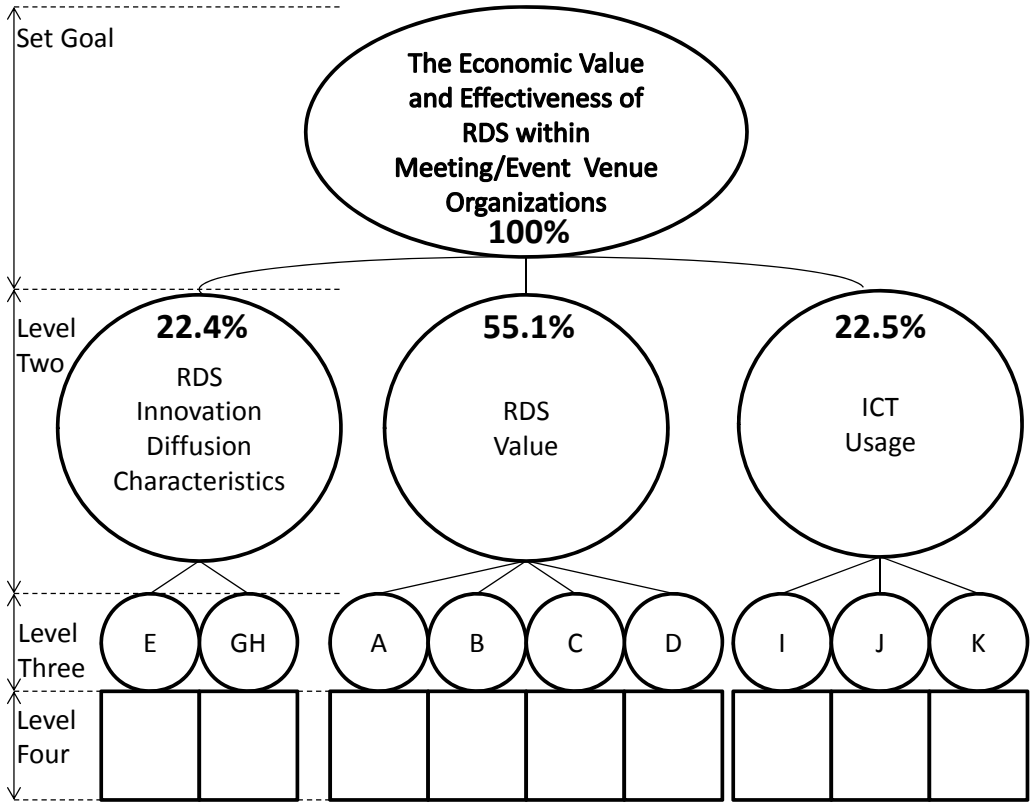

Figure 13 – The Weighted Categories from the Round Three of the Modified Delphi Study

Table 36 – The Weighted Key Performance Indicators from the Round Three of the Modified Delphi Study

Factor Tier	Weighting		Key Performance Indicator
	at Level Three	at Level Four	
Factor Tier **A_ Impact on Sales**	**12.7%**	**4.6%**	A1_Increased number of new clients
		4.2%	A2_Booking rate at the meeting/event venue
		3.9%	A4_Sales per labour hour
Factor Tier **B_ Impact on Efficiency**	**12.3%**	**2.4%**	B1_Costs of internal processes and labour costs
		4.6%	B2_Total labour working hours
		3.7%	B3_Costs of coordinating business partners
		1.6%	B4_Marketing costs
Factor Tier **C_ Impact on Business Partner Relationships**	**7.6%**	**1.5%**	C1_Interactive service quality with meeting/event service suppliers
		6.1%	C2_Interactive service quality with meeting/event planners
Factor Tier **D_ Impact on Customer Satisfaction**	**22.5%**	**3.5%**	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up
		7.8%	D2_Interactive service quality with meeting/event guests
		11.2%	D3_Satisfaction of meeting/event planners
Factor Tier **E_ Compatibility**	**11.8%**	**2.7%**	E1_RDS products and services are compatible with the event venues' current selling processes
		4.3%	E2_RDS products and services are compatible with the existing distribution channels
		4.8%	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems
Factor Tier **GH_ Observability and Trialability**	**10.6%**	**6.4%**	G1_Observability
		4.2%	H1_Trialability
Factor Tier **I_ Technology Competence**	**11.9%**	**4.6%**	I1_ICT Infrastructure
		4.2%	I2_ICT Skills
		3.1%	I3_Skill Development
Factor Tier **J_ Organisational Context**	**6.9%**	**2.2%**	J2_Financial Commitment
		4.7%	J3_Organisational Scope

Factor Tier **K_ External Environmental Context**	**3.6%**	**2.3%**	K1_Perceived Competitive Pressure
		1.3%	K2_Perceived Stakeholder and Social Pressure

Comparing the Table 35 and 36, the high rankings and weightings of importance of ICT impact on customer satisfaction (the indicators of D2 and D3) and business partner relationships (the indicator of C2) in the category of ICT value are similar to the research results of Fuchs et al. (2010) on eBusiness adopting hospitality organisations in value creation processes.

7.3 AHP Mass Survey Phase Conclusions

Thirdly, it has been claimed that little innovation diffusion research has focused on the relative contribution of the innovation diffusion characteristics such as compatibility with, and complexity of the adoption (Rogers 2003). The research presented bridged this gap in the innovation diffusion research through aggregating the opinions from an expert panel and venue managers working in the field by means of the technique of Analytic Hierarchy Process (AHP). The present empirical results have a more sophisticated weighting method which numerically evaluates venue managers' perceptions of the economic value and effectiveness of RDS. The effective responses from the 48 experienced venue managers, therefore, are invaluable for future research in the field of meeting and event technology management. To the author's best knowledge, the findings were the first ever of this kind in the field and could provide a springboard for further research.

In this phase of the research, a mass survey of all the US-based customers within the chain hotel systems from the MeetingMatrix Customer Relationship Management database, 48 ICT investment decision makers, meeting and event managers or hotel sales managers provided their views on the important levels of priorities and weightings of the 24 Key Performance Indicators (KPIs). A pairwise-comparison technique (Analytic Hierarchy Process, AHP) was used in the survey to prioritise and to give weightings to each KPI, each Factor Tier and each category. These KPIs have the potential to be used in the evaluation and monitoring of the continuous and

sustainable economic value and effectiveness of Room Diagramming Solutions (the set Goal). For example, as seen in Figure 14 and Table 37, the AHP technique helps to synthesise a group consensus that 45.8% of the hierarchical index system should be composed of the indicators which explain RDS-related ICT usage in the adopting hotels (at Level Two). Moreover, under the RDS-related ICT usage category, the group indicators on "Factor Tier I_external environmental context: the external arena in which a hotel conducts its business" at Level Three (sub-category, the Factor Tier) should account for 20% of the set Goal. The indicator "I2_perceived stakeholder and social pressure: the extent to which downstream customers (meeting/event planners) expect ICT room diagramming solutions to be used and have eBusiness systems ready to support the services" at Level Four should account for 13.4% of the set Goal.

As demonstrated in the Figure 14 and Table 37, the findings from this RDS research are similar in some aspects to the perspectives which have been discovered in the hospitality industry such as the high rankings of importance of ICT impact on customer satisfaction and business partner relationships for eBusiness adopting hospitality organisations in value creation processes (Fuchs et al. 2010). Cost reduction and direct sales improvement were not considered as the most important indicators for monitoring the post-adoption performance of RDS in venue management. This is similar to the findings of the study conducted by Fuchs et al. (2009) for eBusiness adoption in Austrian hotels. Furthermore, among the 24 validated Key Performance Indicators (KPIs) within the framework for monitoring the economic value and effectiveness of RDS, the indicator "I2_perceived stakeholder and social pressure: the extent to which downstream customers (meeting/event planners) expect ICT room diagramming solutions to be used and have eBusiness systems ready to support the services" was rated as the most important indicator and accounted for 13.4% of the set Goal. ICT applications such as RDS may help event organisers and service providers to "fulfil their primary goal to produce a meeting that meets a client organisation's goals" and enable the client to better understand the value that the organisers and service providers add to events (Lee et al. 2013 p. 8). Combining these results, it may be concluded that in the hospitality industry customer and business partner satisfaction are crucial in term of

the created economic value of ICT applications to property management organisations no matter before or after ICT adoption. RDS is similar to other eBusiness applications in the hospitality industry from this perspective.

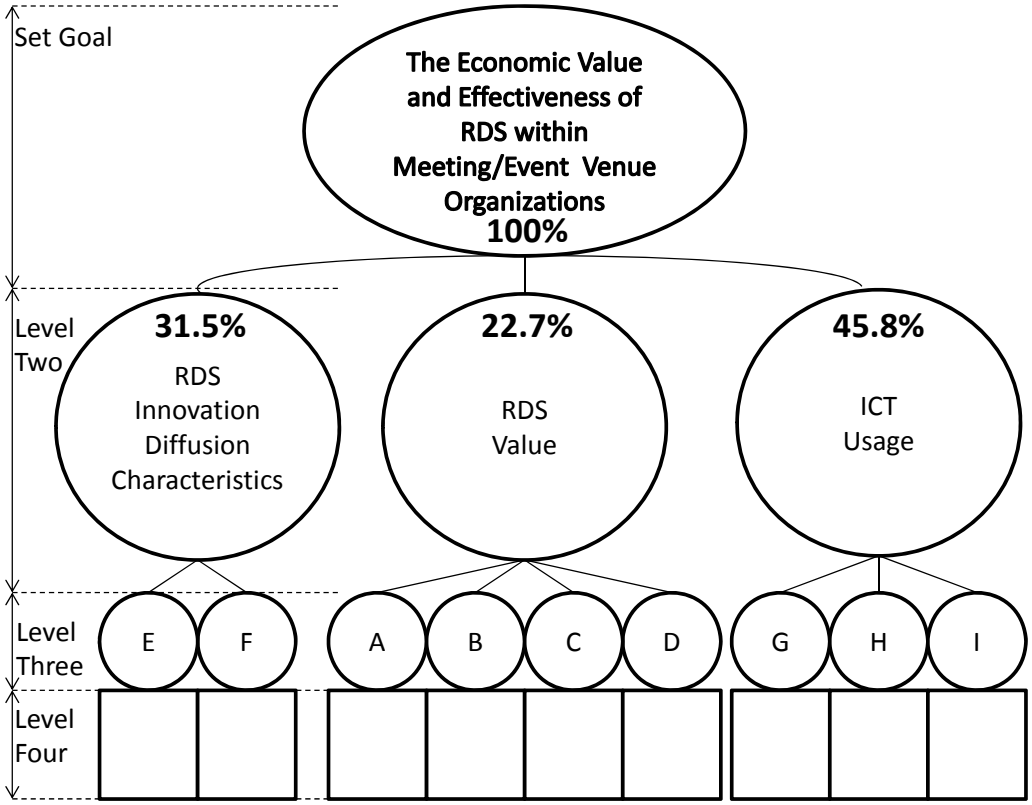

Figure 14 – The Weighted Categories from the Results of the AHP Mass Survey

Table 37 – The Weighted Key Performance Indicators from the Results of the AHP Mass Survey

Factor Tier	Weighting		Key Performance Indicator
	at Level Three	at Level Four	
Factor Tier **A_ Impact on Sales**	**2.5%**	**0.50%**	A1_Increased number of new clients
		1.30%	A2_Booking rate at the meeting/event venue
		0.70%	A4_Sales per labour hour
Factor Tier **B_ Impact on Efficiency**	**3.8%**	**0.60%**	B1_Costs of internal processes and labour costs
		1.00%	B2_Total labour working hours
		1.20%	B3_Costs of coordinating business partners
		1.00%	B4_Marketing costs
Factor Tier **C_ Impact on Business Partner Relationships**	**5.1%**	**1.50%**	C1_Interactive service quality with meeting/event service suppliers
		3.60%	C2_Interactive service quality with meeting/event planners
Factor Tier **D_ Impact on Customer Satisfaction**	**11.2%**	**2.30%**	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up
		3.00%	D2_Interactive service quality with meeting/event guests
		5.90%	D3_Satisfaction of meeting/event planners
Factor Tier **E_ Compatibility**	**12.9%**	**2.80%**	E1_RDS products and services are compatible with the event venues' current selling processes
		4.10%	E2_RDS products and services are compatible with the existing distribution channels
		6.00%	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems
Factor Tier **F_ Observability and Trialability**	**18.5%**	**11.20%**	F1_Trialability
		7.30%	F2_Observability
Factor Tier **G_ Technology Competence**	**11.0%**	**1.80%**	G1_ICT Infrastructure
		3.10%	G2_ICT Skills
		6.10%	G3_Skill Development
Factor Tier **H_ Organisational Context**	**14.8%**	**5.60%**	H1_Financial Commitment
		9.20%	H2_Organisational Scope

Factor Tier **I_ External Environmental Context**	**20.0%**	**6.60%**	I1_Perceived Competitive Pressure
		13.40%	I2_Perceived Stakeholder and Social Pressure

Furthermore, the 48 experts gave the factor tier of external environmental context, which comes from the TOE framework theory, the highest weighting among the nine factor tiers and accounting for 20% of the set Goal. This result strengthens the claim made by the critical mass theory which believes that when the total number of adopters for a specific innovation increases, then its value to users also increases (Lee et al. 2013).

7.4 Practical Implications

This research has contributed to three areas in general. Firstly, the results supply an approach to monitor the economic effectiveness of Room Diagramming Solutions (RDS) usage after the investment has been made. Secondly, from the comments and feedbacks supplied by the members of the expert panel and venue managers the findings clarify RDS value and impact in the process of value creation in meeting and event venues. Thirdly, the results may provide evidence to justify and support the decision of RDS investment in venue management.

In addition, the research results scientifically generated economic and operational priorities of the venue clients' needs in terms of RDS products and services. The priorities may provide insights to RDS suppliers for providing better services to customers. The research findings can also be developed to explore and set up the priorities of the Research & Development plan for RDS suppliers. Furthermore, by taking the research results, RDS service providers could develop and provide a practical framework and products for its venue clients to enable them to monitor the sustainable economic value and effectiveness of RDS in use (Chang and Yu 2001; Hsieh et al. 2006).

The research results have confirmed and provided scientific evidence that the strategies which have been used in RDS service providers as for building close

collaborations with meeting and event planners are progressing in the right direction (MeetingMatrix 2012; MET LAB 2011). The indicators which were identified with high priorities by venue managers and ICT investment decision makers such as "I2_perceived stakeholder and social pressure: the extent to which downstream customers (meeting/event planners) expect ICT room diagramming solutions to be used and have eBusiness systems ready to support the services", "D3_Satisfaction of meeting/event planners" and "C2_Interactive service quality with meeting/event planners (e.g. wedding or exhibition planners)" are all concerned with the feelings, perceptions and circumstances of meeting and event planners to RDS products and services. Furthermore, many respondents comment that they believe the most important expected and measurable economic value of RDS to their businesses is the improvement of relationships with meeting and event planners, their customers, rather than decreased costs or increased guest numbers.

From the AHP mass survey results, the high priority of indicators of "F1_Trialability: the degree to which the meeting/event planners perceive RDS products and services (e.g. MeetingMatrix or Newmarket Delphi Diagrams) in the targeted venues' websites as easy to experiment with and try (i.e. what waiting time is needed to install or log into the trial version of RDS products and services from the hosting downloadable page)" and "F2_Observability: the degree to which the meeting/event planners perceive RDS products and services (e.g. MeetingMatrix or Newmarket Delphi Diagrams) in the targeted venues' websites as visible and easy to find (i.e. how many transferring web pages are needed from the venue's web front page to the page hosting RDS products and services)" indicate the need to optimise the layout and web hosted-location of RDS products and services in the adopting hotels' websites. RDS service suppliers may provide some best practices or examples to assist the clients in achieving the optimisation. This result also provides robust evidence for the development of the prospective cloud-based products and services with high trialability and low installation time comparing it with traditional software products (MeetingMatrix 2012). This industrial trend has also been confirmed by other general Computer-Aided Designing (CAD) software providers such as the launch of Adobe Photoshop Creative Cloud products (Gee 2013) and by general

office software suite providers such as the services of Microsoft Office Web Apps (Microsoft Corporation 2013).

Having a compatible corporate innovation culture and value systems within the RDS adopting meeting/event venues has been regarded as an important antecedent for the success and economic effectiveness of RDS (due to the high priority of the indicator E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems). RDS service providers may target the potential clients having this culture and these value systems. Furthermore, some educational programs about how to improve and cultivate the culture and value systems may be provided to the existing clients in order to ensure their continuous success in the adoption of RDS.

The high priority of indicator "H2_Organisational Scope: amount and size of diagramable spaces in the venue" indicates that the venue clients with more diagramable spaces or high potential to grow their diagramable spaces could be targeted as potential clients when conducting marketing campaigns. It could be explained that the respondents believe in the effect of economies of scale in relation to the investment of RDS. A statement was made by one of the expert panellists: "while budget is often a key factor of innovation and adoption of new technology, this is a very unique case. Diagramable space of a venue would be a more important factor of MeetingMatrix (RDS)" (Unique Response Number: 9564616 from Delphi Round Two).

7.5 Recommendations and Limitations

Firstly, it is claimed that "the combined judgment of groups displays greater intelligence than isolated individuals and can often provide surprisingly accurate estimates when four conditions are met: diversity of opinion, independence of opinions, decentralized local knowledge, and a mechanism for aggregating judgments" (Crouch 2011, p. 31). Although the research findings, which stem from the opinions of a group of users, investment decision makers and stakeholders of RDS applications, must be viewed as indicative and perception-based (Babbie 1995;

O'Connor and Frew 2004), a practical set of indicators for consideration of the RDS evaluation process has been provided for further development and exploration. However, in future studies, research methods such as focus groups may be employed for revalidation of the proposed indicators in this project (Reino et al. 2013). Further cross validation of the results, which concern economic value and effectiveness and based purely on subjective data may benefit from work with additional objective data (Sigala et al. 2004; Zhu et al. 2006). This research which develops a framework could be viewed as the first step of a longitudinal study of the economic impact and effectiveness of RDS which may provide dynamic views of the specific ICT innovation usage and impact in venue management. In future studies, the implementation of this framework in venues may provide data for further longitudinal investigations.

Secondly, the KPIs selected and identified in this research could also be adopted for conducting research concerning other performance measurements such as the ICT Balanced Scorecard for strategic management. It is suggested that when designing and implementing a specific ICT Balanced Scorecard, the first step is to identify the representative and meaningful measures for the ICT itself (Buglione et al. 2001). From the research results of the modified Delphi survey of an expert panel and the AHP mass survey sent to targeted venue managers in this thesis, it can be found that though different priority techniques were used and different groups of people were consulted, there is consistency existing in the priorities of KPIs in Factor Tiers C_Impact on Business Partner Relationships, D_Impact on Customer Satisfaction, Factor Tier E_Compatibility and H_Organisational Context as demonstrated in Table 38. Table 38 triangulates the research findings of the Likert Scale of the Modified Delphi study, the AHP Technique of the Modified Delphi study and the AHP Mass Survey Study. The members of the expert panel and the industrial practitioners all reached a consensus that the KPIs of “C2_Interactive service quality with meeting/event planners”, “D3_Satisfaction of meeting/event planners”, “E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems” and “H2_Organisational Scope” are the most important criteria in the factor tiers in which they are allocated

within the evaluation framework. In addition, from the perspective of the ontological presumptions which this research set, these results may imply that there seems to an external reality existing to the expert panel and industrial practitioners surveyed that the KPIs of “C2”, “D3”, “E3” and “H2” have high priorities over the other KPIs. This external reality is reflected from the consensus and judgement of the aggregated opinions and perceptions by diversified, independent and trained individual through a mathematical mechanism.

Table 38 – Comparisons of Priorities in KPIs

Factor Tier	**KPIs**	**Importance Ranking**			
		M	**R3**	**R2A**	**R2**
		N=48	**N=6**	**N=6**	**N=11**
Factor Tier **A_ Impact on Sales**	A2_Booking rate at the meeting/event venue	1	2	1	1
	A3_Sales per labour hour	2	3	1	2
	A1_Increased number of new clients	3	1	3	3
Factor Tier **B_ Impact on Efficiency**	B3_Costs of coordinating business partners	1	2	2	2
	B4_Marketing costs	2	4	4	4
	B2_Total labour working hours for making meeting and event spaces set up ready	3	1	2	1
	B1_Costs of internal processes and labour costs	4	3	1	3
Factor Tier **C_ Impact on Business Partner Relationships**	C2_Interactive service quality with meeting/event planners	1	1	1	1
	C1_Interactive service quality with meeting/event service suppliers	2	2	2	2
Factor Tier **D_ Impact on Customer Satisfaction**	D3_Satisfaction of meeting/event planners	1	1	1	1
	D2_Interactive service quality with meeting/event guests	2	2	1	2
	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up	3	3	3	3
Factor Tier **E_ Compatibility**	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems	1	1	2	1

	E2_RDS products and services are compatible with the existing distribution channels	2	2	1	2
	E1_RDS products and services are compatible with the meeting/event venues' current selling processes	3	3	3	3
Factor Tier **F_ Observability and Trialability**	F1_Trialability	1	2	1	2
	F2_Observability	2	1	2	1
Factor Tier **G_ Technology Competence**	G3_Skill Development	1	3	3	3
	G2_ICT Skills	2	2	1	1
	G1_ICT Infrastructure	3	1	2	2
Factor Tier **H_ Organisational Context**	H2_Organisational Scope	1	1	1	1
	H1_Financial Commitment	2	2	2	2
Factor Tier **I_ External Environmental Context**	I2_Perceived Stakeholder and Social Pressure	1	2	1	1
	I1_Perceived Competitive Pressure	2	1	1	1

M=AHP Mass Survey
R3=Delphi Round Three (AHP Pairwise Comparison)
R2A=Delphi Round Two (Likert Scale Importance Rating; also responded in AHP)
R2=Delphi Round Two (Likert Scale Importance Rating)

The comparability of these research results to the other similar research papers such as Fuchs et al. (2010) and Zhu et al. (2006) is, however, limited, because not only are the components of the factor tier and the definitions of the KPIs varied among different studies due to the functionality of the different eBusiness applications focused on, but the different research concerns and methodologies used are also varied. For example, in the research conducted by Fuchs et al. the research concerns are not the rankings and the priorities of the KPIs but the internal influences among factor tiers and KPIs by the use of the linear structural equation modelling approach. The current thesis avoids over-interpreting the research results and develops the conclusions, explanations of the research results and the comparisons of the related literature and the current findings when there is scientific evidence from quantitative approaches. This perspective follows the ontological presumptions that this research set in the philosophical positions at the top of this research umbrella. Different concerns around innovation diffusion contribute diverse diffusion research studies and add value to each of the social science disciplines. Different from the focuses of

previous relevant research, this study does not put emphasis on the internal relationships among the factors in varied dimensions. A hierarchical view has been used in order to concentrate the research focuses on exploration of the relative degrees of association of these factors to the goal, the economic value and effectiveness of RDS. More following related research which embarks from the findings of the current thesis will build up insights block by block in the research vein of ICT in travel and tourism and event management, or further to the general research of ICT innovation diffusion.

As stated by the winner of 2013 Nobel Prize in Economics, Robert J. Shiller (2013), "…economics is rather more like engineering than physics, more practical than spiritual… economics is somewhat more vulnerable than the physical sciences to models whose validity will never be clear, because the necessity for approximation is much stronger than in the physical sciences, especially given that the models describe people rather than magnetic resonances or fundamental particles. People can just change their minds and behave completely differently. They even have neuroses and identity problems, complex phenomena that the field of behavioral economics is finding relevant to understanding economic outcomes. But all the mathematics in economics is not, as Taleb suggests, charlatanism. Economics has an important quantitative side, which cannot be escaped. The challenge has been to combine its mathematical insights with the kinds of adjustments that are needed to make its models fit the economy's irreducibly human element…while economics presents its own methodological problems, the basic challenges facing researchers are not fundamentally different from those faced by researchers in other fields. As economics develops, it will broaden its repertory of methods and sources of evidence, the science will become stronger, and the charlatans will be exposed".

Thirdly, consistency index (CI) and consistency ratio (CR) are used in the technique of AHP to evaluate the degree of closeness to consistency. It is suggested that a CI or a CR of 0.10 (10%) or less could be considered as a tolerable error in measurement (Benlian 2010; Saaty 1980; Shih and Gong 2010). It is suggested that the inconsistency could be improved through asking surveyees to reconsider the original

values in the pairwise comparison matrix or through conducting sensitivity tests in order to eliminate the values which have high inconsistency (Shih and Gong 2010; Tsai and Ho 2009). Considering the limitations of time and resources, some data from surveys in this research were eliminated. However, it is found that in most cases inconsistency typically exists in pairwise comparison, and therefore it is argued that consistency is not always required by or necessary to an AHP (Bortot and Pereira 2013). Transitive law is used to form the foundation of the consistency tests of the AHP technique, and utility theory assumes that a rational decision maker with full information is able to consistently process preference choices over time (Knoll 2010). It is claimed that individual choice experiments which lack immediate information feedback could violate expected utility theory (Cox and Grether 1996). Therefore, in future research the function of immediate information feedback to research respondents regarding the violation of consistency tests of AHP may be included in the functionality of an online AHP survey in order to avoid possible inconsistency emerging from the subsequent AHP results (Ishizaka and Lusti 2004).

Moreover, the disclosure of the inconsistency in this research may urge future research to conduct a revalidation of the components within the structure of the AHP. It is suggested that in some cases of AHP research the inconsistency which is discovered may be associated with the comparability of the components within the clusters (Saaty and Vargas 2012). Table 39 demonstrates the difference between the original weightings and the adjusted weighting of the results from the AHP mass survey in this project. However, it can be found that even if there are slight differences between the adjusted and the original weightings, the rankings of the categories, the factor tiers and the KPIs among each cluster are not affected by the adjustment caused by the inconsistency.

Table 39 – Comparisons of Original and Adjusted Weightings in the Result of AHP Mass Survey

Factor Tier	**Weighting**				**Key Performance Indicator**
	at Level Three		**at Level Four**		
	AdM	**M**	**AdM**	**M**	
Factor Tier **A_ Impact on**	**2.5%**	**2.3%**	**0.5%**	**0.5%**	A1_Increased number of new clients

Sales			**1.3%**	**1.2%**	A2_Booking rate at the meeting/event venue
			0.7%	**0.6%**	A3_Sales per labour hour
Factor Tier **B_ Impact on Efficiency**	**3.8%**	**3.8%**	**0.6%**	**0.6%**	B1_Costs of internal processes and labour costs
			1.0%	**1.0%**	B2_Total labour working hours
			1.2%	**1.2%**	B3_Costs of coordinating business partners
			1.0%	**1.0%**	B4_Marketing costs
Factor Tier **C_ Impact on Business Partner Relationships**	**5.1%**	**5.2%**	**1.5%**	**1.5%**	C1_Interactive service quality with meeting/event service suppliers
			3.6%	**3.7%**	C2_Interactive service quality with meeting/event planners
Factor Tier **D_ Impact on Customer Satisfaction**	**11.2%**	**11.8%**	**2.3%**	**2.4%**	D1_Satisfaction level of meeting/event guests directly attributable to functionality of meeting/event room's set up
			3.0%	**3.2%**	D2_Interactive service quality with meeting/event guests
			5.9%	**6.2%**	D3_Satisfaction of meeting/event planners
Factor Tier **E_ Compatibility**	**12.9%**	**12.9%**	**2.8%**	**2.8%**	E1_RDS products and services are compatible with the event venues' current selling processes
			4.1%	**4.1%**	E2_RDS products and services are compatible with the existing distribution channels
			6.0%	**6.0%**	E3_Adopting RDS products and services is compatible with the meeting/event venues' corporate innovation culture and value systems
Factor Tier **F_ Observability and Trialability**	**18.5%**	**18.6%**	**11.2%**	**11.3%**	F1_Trialability
			7.3%	**7.3%**	F2_Observability
Factor Tier **G_ Technology Competence**	**11.0%**	**11.0%**	**1.8%**	**1.9%**	G1_ICT Infrastructure
			3.1%	**3.2%**	G2_ICT Skills
			6.1%	**5.9%**	G3_Skill Development
Factor Tier **H_ Organisational Context**	**14.8%**	**14.6%**	**5.6%**	**5.5%**	H1_Financial Commitment
			9.2%	**9.1%**	H2_Organisational Scope
Factor Tier **I_ External**	**20.0%**	**19.8%**	**6.6%**	**6.5%**	I1_Perceived Competitive Pressure

Environmental Context			**13.4%**	**13.3%**	I2_Perceived Stakeholder and Social Pressure

M= weightings generated from original AHP Mass Survey data
AdM= weightings generated from adjusted AHP Mass survey data

Fourthly, the AHP mass survey respondents in this project were from the client database of a leading RDS products and services provider, MeetingMatrix. Because of the complexity of the AHP technique, convenience sampling is usually used in relevant research designs such as Crouch's research of identification of destination competitiveness (Crouch 2011). Furthermore, due to the limited research resources in this project, this study could not target the population of every RDS venue manager in the US chain hotels who have used RDS but merely MeetingMatrix users and contacts from the company's database, the targeted venue managers. In future studies, clients from other RDS suppliers such as Newmarket may be surveyed, and the revalidation of this framework may be achieved.

Fifthly, the low response rate experienced in this research may limit its ability to make generalised conclusions based on the research findings. However, to the author's best knowledge, there are no published academic articles that focus on the economic value and effectiveness of RDS to venue operators. The present empirical results have a more sophisticated weighting method which numerically evaluates venue managers' perception on the economic value and effectiveness of RDS using AHP. The effective responses from the 48 experienced venue managers, therefore, are invaluable for future research in the field of meeting and event technology management. Furthermore, according to the set aim and objectives of this research, several philosophical presumptions are implied, and the nature and limitations of this research are also disclosed. This research took the position of the existence of an external economic reality that governed past, present and future economic outcomes: a single social reality. In this research, the aim and major concerns are to establish a framework which could be used by venue managers to evaluate the economic value and effectiveness of a specific ICT innovation, RDS. The economic value and effectiveness are, therefore, regarded as external reality in the chosen ontological position. The managers could tend to the view that the economic goals which their

organisations pursue are an external reality. The managers learn and apply the economic regulations and rules. Therefore, there is an existence of some priorities of their economic goals and the accompanying KPIs to these goals. Through comparing the research findings of AHP mass survey and the modified Delphi surveys in this research, some priorities among the proposed Key Performance Indicators have been cross-validated by two different groups (Expert Panel; Industrial Practitioners) through the use of two different techniques (Likert Scale; AHP Technique). The findings could, therefore, provide a springboard for further research (Bryman and Bell 2011).

Sixthly, it was found that the length of surveys contributed to the non-response rate for the studies targeting business people (Sheehan 2001). The experienced low response rate in the AHP mass survey of this project may result from the relatively complex pairwise comparison processes and the length of the pairwise comparison survey. In future studies, firstly the additional findings from the comparisons of the results of this research may be used to select some focused KPIs in order to reduce the complexity of the pairwise comparison processes and the length of the pairwise comparison survey. Secondly, the issues may be improved by exploring advanced mathematical approaches such as Fuzzy Preference Relations (Herrera-Viedma et al. 2004) and Chainwise Paired Comparisons (Ra 1999) which claim to supply methods to reduce the number of questions which need to be asked in the AHP processes and to provide solutions for dealing with the inconsistency issues which are sometimes encountered in AHP results. In addition, one of the main assumptions of AHP is that the evaluating elements should be independent of each other. By applying the advanced approach of Analytic Network Process (ANP) which allows feedback influences and interactions among all elements, future research may investigate the relationships among all elements and then generate weightings as shown in Figure 15 (Saaty 2005).

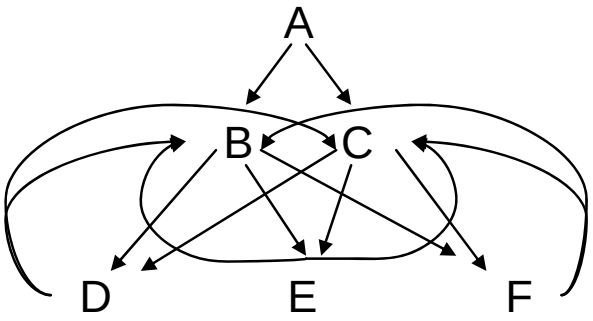

Figure 15 – ANP Relationships with Feedbacks and Interactions

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